CTOBER 1959 VOLUME 8 . NUMBER 10

# Battelle Technical Review

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**VIGNETTE**

RANDALL G. HEILIGMANN

The creativity of technologists in the rubber and plastics field has led to a host of new products. The outstanding achievement, in the belief of Battelle's Randall G. Heiligmann, has been the nature of their brainchildren. "Today, engineering with rubber and plastics means designing with many materials that didn't exist a decade ago. What is even more significant, these novel products—which are true materials of construction—are not substitutes for anything, but stand squarely on their own merits."

Randy has been associated with rubber and plastics research since 1945. At Battelle he has participated in studies of both thermoplastic and thermosetting resins and has been concerned with the development of high - temperature and oil - resistant elastomers. The broad character of his interests is shown by the scope of the investigations in which he has participated.

He and his colleagues have synthesized basic polymers—the building blocks that make up plastics — developed processing techniques, and devised many end-item products. In the course of their research, they have synthesized novel high-impact styrene-based plastics, explored the transition behavior of polychloroprene and various elastomer blends, have conducted, and have just completed a study of the factors influencing the stability of SBR latex. Continuous studies on the polymerization of ethylene to polyethylene have been conducted over a period of ten years, and recently Randy and his associates have been investigating the heterogeneous catalysis of unsaturated hydrocarbons. They have also made important contributions to the understanding of the effects of radiation in modifying polymeric materials.

Among noteworthy developments engaging his interests has been a three-component polyamide—for insulating communications wire—with improved heat, moisture, and ultraviolet resistance. At present an investigation of the value of polymers in improving the dimensional stability of wood, is under way.

In earlier activities, Randy, who is now chief of Battelle's rubber and plastics division, was engaged in studies of hydrocarbon transformations at Atlantic Refining. Prior to this and while with Permutit he cooperated in the development of one of the first organic ion exchangers. He received his undergraduate and graduate degrees in chemistry from Temple University.

Randy's studies have led to 25 patents and to more than a dozen publications. Currently he is a member of The American Chemical Society and of the New York Academy of Science.

With his wife Donna, Randy finds himself involved in the whirlwind of the lives of their two teen-age sons. A veteran in model railroading, he likes to take his athletics—football and baseball—sitting down.

# BATTELLE TECHNICAL REVIEW

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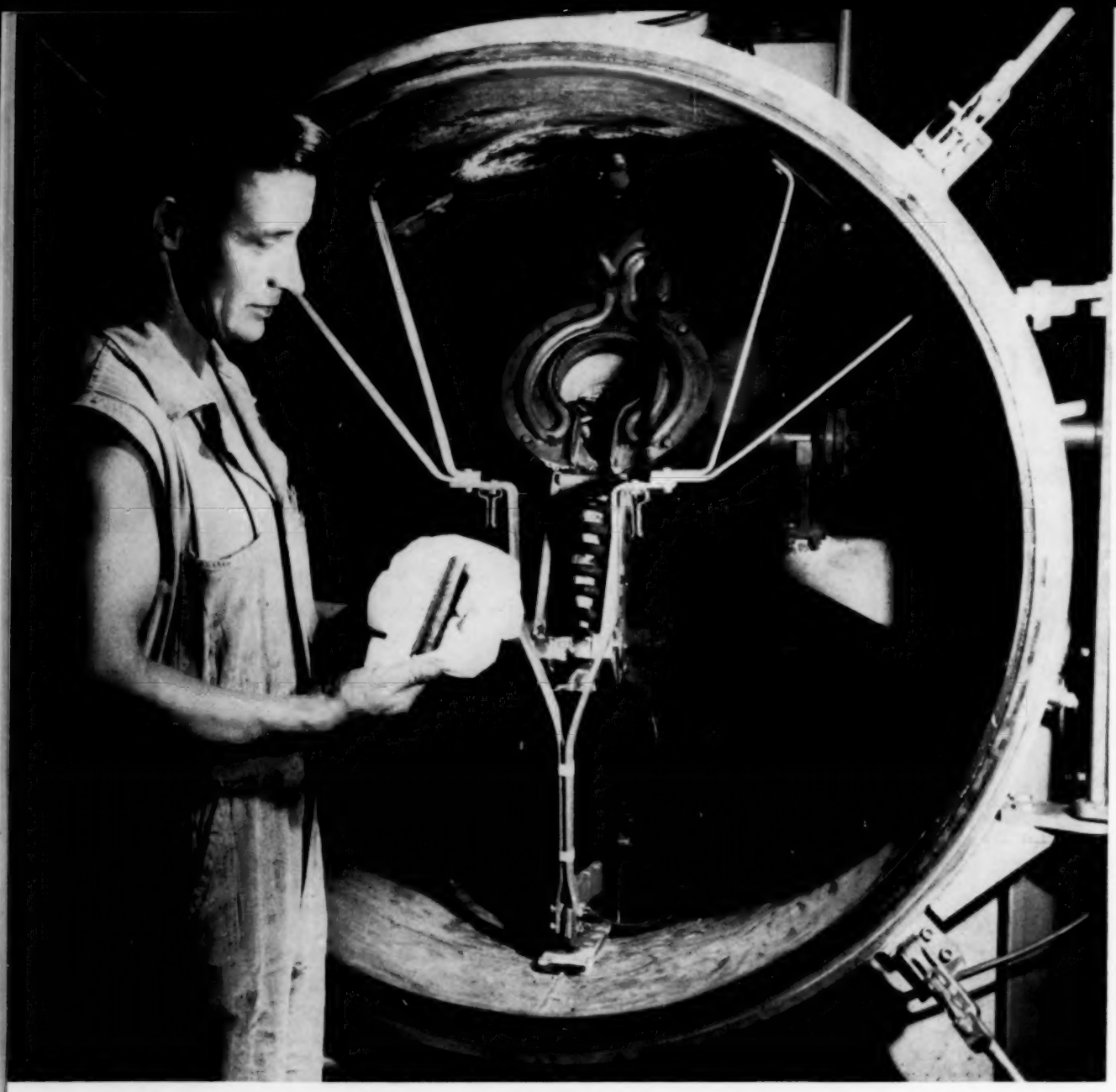


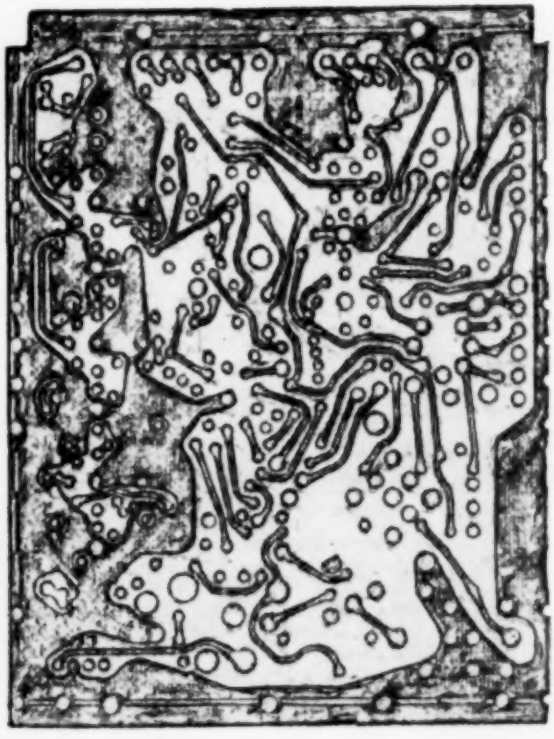
## TOWARD BETTER PREPARATION OF METALS FOR RESEARCH

Walter J. Hildebrand inspects the first uranium monocarbide reactor fuel element cast in a skull-type vacuum arc-melting furnace recently installed at Battelle. This accomplishment was made possible by modifications of the furnace that permit a variety of molding practices. Contamination of reactive and refractory metals is kept to a minimum because they are melted in water-cooled skulls of the same materials. At the same time, the high temperatures (to above 6000 F) obtainable with the high-current arc enable preparation of a considerable volume of molten metal. Studies involving the melting of uranium, zirconium, niobium, chromium, and tantalum are planned in connection with the use of this furnace. Modifications were made under the direction of E. L. Foster, and W. J. Phillips.

*The use of printed circuits, already widespread, will be greatly extended by improvements in their low-and high-temperature, radiation-resistant, and other properties. The author discusses organic-coating needs and developments that are important in extending the areas in which printed circuits can be utilized.*

# Organic Coatings for Printed Circuits

*by* BENSON G. BRAND



THE USE OF PRINTED CIRCUITS is becoming more and more widespread, especially in military electronics They are used increasingly in the fabrication of radio, television, and high-fidelity equipment. Their greatest importance lies in the fact that such circuits make miniaturization easier, provide more mechanically rugged units, and lend themselves to automated production because of their easy and accurate reproducibility, so important in some high frequency applications. Printed circuits have proved their value for computers, radar, communication equipment, telemetering, control units in missiles and satellites, and for numerous other applications only now assuming significant magnitude. Use of circuits of this nature for industrial electronic control applications, automotive circuitry, and home-appliance wiring is still in its infancy, but appears to have a bright future.

As the complexity of the applications for printed wiring increases, a subsequent increase can be expected in the demand for stability over a wider range of conditions. For example, the use of electronic circuits in extremely high-speed applications such as supersonic aircraft and missiles has imposed an almost unbelievable temperature requirement on the electronic components. As the speed of an airborne object increases, its skin temperature also rises giving a correspondingly higher temperature within the aircraft; temperatures in excess of 400-500 F can be expected. The point has now been reached with manned aircraft where the pilot's compartment must be air conditioned to insure his surival. Since electrical and electronic components normally are not in the air-conditioned portion of the craft, they must bear the brunt of the increasing temperatures. It is necessary, therefore, that the electrically insulating coating component withstand temperatures of this nature without deterioration.

It is also readily apparent that the increased speeds result in increased demands for vibration-resistant materials. Printed circuits are not rigid bodies, and they consequently develop considerable vibration across their surface. This vibration subjects the base, the adhesive, the conductor, and the protective coating to serious flexing, which frequently results in fatigue failure. Extreme acceleration and deceleration are also encountered in many telemetering applications which subject the components to shock. The complete system must, therefore, be designed to withstand quite high forces.

## NATURE OF PRINTED CIRCUITS

Printed wiring can be defined as a prefabricated unit of construction designed to eliminate or minimize

the point-to-point wiring using copper or other metal wire in electronic construction. The National Bureau of Standards has listed and described 19 different methods of preparing prefabricated wiring for electronic circuits, all of which involve the application of a conductive element on an insulating base in the desired geometric pattern.

Organic coatings are an essential part of this fabrication, regardless of the method of manufacture, and can either contribute to success or failure in the electrical behavior of the finished circuit. Such functions as those performed by the adhesive for a foil laminate, the binder for a conductive or resistive paint, and the protective coating to seal out moisture and ionizable impurities and to protect the delicate components from mechanical damage are all in the realm of organic coatings chemistry, and are all critical factors in determining the performance of the finished electronic item. The limitations of printed wiring are almost completely imposed by the limitations of the organic coatings that are used in their production. Hence, it can be concluded that, in order to extend the use of printed wiring to new and more critical applications, it is necessary to improve the properties of the organic coatings that are a basic part of these components.

For the purposes of simplicity we shall consider all organic materials that are applied to the circuit in liquid form as organic coatings. Adhesives will be included in this category as well as the protective coating that is applied after the circuit has been formed. The more significant types of organic coatings used in the production of printed circuits will be discussed also.

## Resinous Components

The adhesive components used in bases can be either thermoplastic or thermosetting material, depending on the method of formation of the printed circuit. For example, in the production of etched circuits, the laminate or base used for the circuit is normally prepared by first making a phenolic-impregnated-paper base. The paper fibers are treated with uncured phenol-formaldehyde resin and are then partially cured under heat and pressure in a hydraulic press with heated platens. Before the resin is completely cured, the sheet is removed from the press and more phenol-formaldehyde resin is applied to one surface of the base over which a sheet of copper foil is then applied. Thereupon, the laminate is returned to the press and the cure is completed. This process develops maximum adhesion of the foil to the base.

Conversely, in the production of die-stamped or die-cut circuits, the laminate is prepared by using a completely cured phenolic-impregnated paper sheet to which has been applied a heat-sensitive adhesive followed by a sheet of copper foil. The heat of the die, when it is applied to the laminate, activates the thermoplastic resin only in those areas contacted by the heated die. In the areas of the unwanted portion of the circuit, no adhesion is developed and these parts may be easily stripped from the board.

Various materials other than the phenol-formaldehyde-impregnated paper have been and are being used for bases. Glass, nylon, or Dacron cloth have been used, and practically any fibrous material can be employed to give the base material additional mechanical strength. Similarly, resins other than phenolformaldehyde have been used: epoxy resins appear to be quite successful for this application, and polyesters have been used in conjunction with glass cloth and glass fibers.

Each of these variations presents additional problems in obtaining the desired degree of adhesion. It is necessary to work out the complete system of base material, adhesive, and metal used for the foil in order to obtain optimum results. Each of the products discussed here presents certain limitations of the complete assembly. Thus, we can see that an adhesive having poor resistance to high temperatures will seriously limit the performance of the finished circuit under such conditions. It becomes apparent, therefore, that in order to increase the scope of application of printed circuits, the properties of the organic components that are used in their production must be improved.

Some of the new materials developed for printed-circuit bases for high-temperature conditions indicate that work is now being done in this direction. For example, a new high-strength glass-ceramic material

Benson Brand has conducted and guided organic-coatings research for well over a decade. His broad experience includes studies on the fundamental properties of such coatings, development of new materials for use in coating manufacture, and the formulation of coatings for special purposes. Among the latter have been preparations for electrical and electronic applications, oil-base and water-thinnable paints, strippable coatings, and others. A continuing interest of the author's has been tall oil, a by-product of the paper industry, which he and his Battelle colleagues have helped to make into valuable materials for coating formulations.

has been announced for circuit-board bases that will withstand temperatures up to about 575 F. It is possible to prepare copper laminates on this base without using any adhesive other than the basic binder used in the ceramic-type board. However, the deficiencies of the protective coating that is applied over the circuit limit the use of this new material. A new epoxy-impregnated glass laminate has been announced that is furnished either plain or with copper cladding on one or both sides. The copper cladding can be made either with or without an adhesive as the bond to the base laminate. When made without an adhesive, it is reported to withstand over 250 F for 30 minutes.

A glass-supported Teflon tape with copper foil bonded to one or both sides will soon be available. It is reported to be quite flexible, able to withstand extremes of shock and vibration, and to have high mechanical strength and dimensional stability. An asbestos-phenolic laminate has also been reported that will withstand short exposures to temperatures as high as 3000 F. It is, therefore, apparent that considerable improvement in the organic coating components of printed circuits is necessary to keep pace with the improved properties of these newer base materials.

### Requirements of Topcoatings

Various types of topcoats can be applied to the circuit after it has been formed. The more important requirements for such coatings are that they provide abrasion resistance, protection of the underlying conductive circuit from atmospheric corrosion, and possess adequate mechanical strength, flexibility, and temperature resistance.

Good electrical characteristics in coatings are of extreme importance, inasmuch as any variations from an electrical standpoint can influence the electrical interaction between adjacent conductors. Thus the resistance between conductors will be largely determined by the properties of the topcoat and its ability to exclude moisture and other deleterious materials that can affect electrical conductivity.

Another desirable property of organic coatings is that of maintaining solderability of metals over which they are applied. It is frequently necessary after coating to solder connectors to the printed circuit or to repair the printed circuit by soldering in new components. To do so, the topcoat must either be readily removable or permit easy soldering of the components without removal of the coating. Topcoats are already available that permit easy soldering without removal. Other properties required in effective coatings for printed circuits, are listed in the accompanying box.

**CHARACTERISTICS OF IDEAL COATINGS FOR PRINTED CIRCUITS***

- **High insulation resistance**
- **Good adhesion to insulating board, wiring, and components**
- **Resistant to abrasion associated with assembly and handling**
- **Crack-proof under vibration and bending**
- **Transparent enough to reveal coding marks and colors**
- **Dielectric strength to resist potential differences between conductors**
- **Easy application, preferably by spraying**
- **Curable at temperatures (c.165 F) not damaging to heat-sensitive components**
- **Noncorrosive**
- **Resistant to hot-spot temperatures and temperature cycling of —90 to 450 F**
- **Qualities enabling removal and replacement of components**

*Based upon listing by R. A. Martel and L. J. Martin in *IRE Transactions*, PGPT - 2, April, 1957, pp. 125-130.

### Some Deficiencies of Coatings

The varied demands upon coatings intended for printed-circuit applications are indicated by the complexity of the evaluation procedures. One of the most important properties, insulation resistance, is determined by the use of a comb pattern, which is more or less standard within the industry. Various other tests outlined in the paper by Martel and Martin include such properties as vibration resistance, temperature-cycling resistance, fungus resistance, humidity cycling according to the required military specifications, abrasion resistance, flexibility, heat resistance, dielectric strength, and solderability.

Practically all of the organic coatings known to date show some deficiencies when subjected to the rather complete series of evaluations. Having to choose the coating or combination of coatings with the fewest deficiencies is therefore usual. For example, it has been

shown that epoxy-polyamides slightly discolor copper conductors. This can be interpreted as meaning that the coating is slightly corrosive toward copper and that any conditions accentuating this corrosion could seriously limit the use of the circuit. In addition, the discoloration indicates that the interface between coating and conductor is undergoing a change that might impair adhesion and the effective life of the coating. Epoxy-polysulfide coatings show blistering of the film and discoloration of the copper when cycled under high humidity. A combination of epoxy, vinyl, and polyamide resins discolors copper. Epoxyamino resin combinations also discolor copper and are subject to a moderate amount of blushing, indicating some water sensitivity. Vinyl coatings typically adhere poorly to phenolic bases. Acrylic resins slightly discolor copper and show moderate blushing when cycled under humidity conditions. Epoxy-phenolic combinations severely discolor copper, with slight blistering of the film when cycled under humidity.

*Problems of Radiation Effects*

A very important subject pertinent to this area has received very little consideration in the technical literature to date—the effect of radiation on organic components of electric and electronic equipment. It is a well-known fact that extensive atomic radiation causes disintegration of organic materials. The polymeric resins used for organic coatings are no exception. Several workers have investigated the action of radiation on organic coatings. Their research shows that the resinous component is the most susceptible to disintegration. However, when the resinous materials are pigmented into paints by incorporating finely divided inorganic materials such as titanium dioxide, calcium carbonate, and barium sulfate into the film composition, the effects of the radiation on the coating materials are very much decreased.

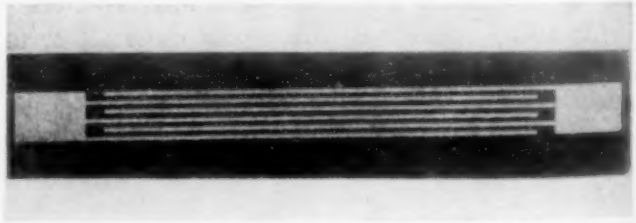
Based on past experience, it appears that the organic coating is likely to be the most radiation-susceptible component of a printed-circuit system and should receive major attention. It can be assumed that electronic applications for use under conditions of atomic radiation will be necessary in the future. It would also appear quite possible that the electronic components would be based on printed circuits. Hence research on an organic protective coating for printed circuits that will give satisfactory performance under a high dosage of atomic radiation appears to be of greatest importance.

It is difficult to predict the behavior of polymeric materials under the influence of atomic radiation. Different types of molecules behave differently. In some cases, the effect is one only of depolymerization, which is evident in a softening of the film followed by its gradual disappearance. In other instances, the decomposition is such that the material gradually darkens and eventually chars. This would be extremely undesirable from an electrical standpoint. It is an indication that the electrical behavior of the coating system would be seriously impaired. Suffice it to say that the behavior of organic coatings under atomic radiation must be very carefully investigated before they are adopted for use for such application. Much research still needs to be done to develop radiation-resistant coatings. Probably much can be accomplished by using the same approach suggested for temperature-resistant coatings. Newly developed polymers, which have improved resistance to elevated temperature, may possibly have improved radiation resistance.

*Need for Fungus Resistance*

Another problem in maintaining the dielectric properties of organic coatings is the control of fungi, which tend to grow on most coatings under proper conditions of misture and humidity. The fungus does little actual physical damage to the coatings. But it tends to limit their dielectric properties by encouraging the retention of moisture on the surfaces and itself serving as a conductor. Some measure of protection against such growth has been achieved by incorporating into the coating film compounds such as phenyl mercury oleate that are toxic to the fungi. However, these materials tend to lose their effectiveness gradually, thus only delaying the development of the fungi and the almost inevitable malfunctioning of the electrical behavior of the circuit. At the same time the choice of a fungistatic or fungitoxic agent is not a simple matter. Most of the agents employed are somewhat specific for the type of resin employed in the coating. In other words, a different fungitoxic agent would probably be required to protect a phenolic resin against fungi than would be required for an acrylic-type resin.

The improvement that appears most difficult to achieve in printed-circuit coatings is their satisfactory performance at the extremes of temperature to which they will be exposed in the higher-speed aircraft of



*Standard comb test pattern for evaluating the quality of printed circuits, including base materials and coatings.*

the future. However, organic coating materials and pigments are being developed that can withstand temperatures unheard of for this class of materials only a few short years ago. Improvements are being made gradually. Although each improvement seems minor, when combined they will result usually in a much more satisfactory over-all behavior of the finished product. A slight improvement in moisture resistance, for example, could improve the volume resistivity of the coating, a desirable characteristic for which many workers are striving at the present time. Although the frontiers are being pushed back very slowly, development of materials appears promising.

### Looking to the Future

In spite of the difficulties referred to above, the future for printed circuits appears to be bright. It has been stated that, within the next 10 years, at least a tenfold increase in the use of printed circuits can be expected. For such growth to be possible the performance of printed circuits will have to be improved to enable their use in additional fields. Temperature ranges lower than the present $-60$ to $-70$ F and higher than the present 400 to 450 F will have to be met. Improvements that have been made in bases have resulted in increased temperature possibilities, both for high and low temperatures. Electronic components such as capacitors, resistors, transistors, and thermistors have been developed that are useful also over a much wider temperature range. It appears that the most serious limitations to the expansion of electronic printed circuits at the present time are the organic components used in their manufacture. Probably the most important of these organic components are the adhesive and the protective films that are applied over the finished circuit.

Applications of printed circuits under conditions of greater amounts of vibration and shock are being encountered. The major point of failure due to vibration and shock is again the adhesive and the protective coating. Applications under conditions of atomic radiation are also occurring and the use for this application is increasing; the most serious deficiency of printed circuits in this area, too, lies in the organic coatings. As indicated by previous experience, with intensified research, desired improvements can be expected to occur bit by bit until satisfactory materials are developed for the desired applications.

Many properties will have to be considered in the selection of a satisfactory material—volume resistivity, dielectric strength, resistance to temperature cycling, resistance to humidity cycling, flexibility, abrasion resistance, corrosion prevention, transparency, and resistance to deterioration from atomic radiation.

In brief, it appears that the application of printed circuits has an almost limitless future. At present the limitations are largely imposed by the shortcomings of the organic components. Improvements in their performance can be expected to result in more diverse application of printed circuits.

## SPIRITUAL VALUES IN SCIENCE

To those of us engaged in scientific work, scientific endeavor is a glorious creative effort of the human race, and full of promise for both the material and spiritual well-being of man and society.

We firmly believe that there are spiritual values in science. We are convinced that truth, beauty and virtue are not the exclusive property of the humanist. Individual scientific work of some great scientists has been the result of a creative act no less sublime than the one that produced a Petrarch sonnet, a Beethoven quartet or a Rembrandt painting. These individual sublime moments in the development of science sparkle against the background glow of the more prosaic work of many scholars whose individuality has been lost. These scientists probed into nature to find scientific truths, inspired by the best ideas and utilizing the best techniques of their time. Their findings, refined into laws and concepts, have been built and are being built into a structure of ideas that represent the creative spirit of science, beautiful to the initiated, glorious as a reflection of God.

**John Turkevich,** before the Conference on "American Human Resources To Meet The Scientific Challenge" at Yale University (1958)

# Radiation Effects on Materials and Systems

*by* Richard E. Bowman *and* Carl J. Lyons

**As nuclear energy reaches into new areas, materials must be developed and systems designed to stand up under the attendant radiation. Here is a discussion of the effects of nuclear radiation upon various materials and the interrelationship of these effects in a system.**

The basic aim of materials, components, and systems design engineering is to provide a product that will reliably perform its intended function within the environment in which it must operate. As technology has advanced and the requirements of society have expanded, increasing demands are made on materials, components, and systems. One example is the constantly growing need for systems that will perform satisfactorily at higher and higher temperatures. A new requirement is for materials, components, and systems that can also "live" in a nuclear radiation environment. That is, radiation has been added to the growing list of combined environments which already includes temperature, pressure, atmosphere, humidity, acceleration, shock, and vibration.

The utilization of nuclear fission as a source of energy for airborne vehicles provides the aircraft and missile systems and sub-systems designer with a radically different and challenging environment. In a nuclear-powered vehicle the radiation environment will be important in three specific areas: (1) crew, (2) the nuclear reactor, and (3) all other materials, components, and systems which make up the vehicle. It is with the last area that we are concerned, namely all the materials, components, and systems (except the crew and the nuclear reactor) that might be used in a nuclear-powered vehicle.

It is the purpose of this article to discuss the radiation environment and its effects on various types of materials and components. To accomplish this, a typical system has been selected that contains many conventional materials and components. The resulting radiation effects problems are reviewed.

All matter is affected to some extent by radiation, although small doses usually cause no appreciable effects. From the figure on page 9 it may be seen that organic materials and semiconductor materials are seriously affected by radiation while metals and ceramics materials in general are more resistant to it.

Radiation effects may be classified into two types: transient and permanent. Transient effects may be defined as changes in operational properties that are noted during an irradiation, but which disappear when the radiation field is removed. Permanent effects begin during an irradiation but persist after it has ended.

In order to better understand these effects on materials, components, and systems it is first necessary to have a basic understanding of the radiation environment including the basic damage mechanisms caused by radiation.

## The Radiation Environment

While it is the design engineer's goal to treat radiation as one additional environment, it should be pointed out that the radiation environment is highly complex and only partly understood. The primary causes for the difficulties are the types and varying energy ranges of the radiation produced in nuclear fission.

Of the radiation produced by a nuclear reactor, the more penetrating gamma rays and neutrons are of chief concern in radiation-effects work. The alpha and beta particles, which are also released as a result of nuclear fission, are readily removed by shielding. These forms of radiation may be described as follows: *Gamma radiation,* electromagnetic waves which are more energetic and penetrating than X-rays; *fast neutrons,* uncharged nuclear particles moving at very high velocities, thus possessing appreciable kinetic energy; and *thermal neutrons,* neutrons moving at velocities equivalent to the kinetic motion of mole-

cules. From an environmental standpoint, the effect of nuclear radiation is complicated not only by the different types of radiation, but also by wide variations in the range of particle velocities and energies.

Gamma radiation effects result from the interaction of the gamma rays with electrons of the material being irradiated. Basically, this is an ionization process and the principal effect is permanent damage to organic compounds. For example, Teflon softens and crumbles, and certain hydrocarbon fluids undergo gassing and decomposition. With inorganic or crystalline materials, including metals, gamma radiation has little effect other than to produce heating. However, gamma radiation causes transient changes in electrical characteristics of semiconductor devices, gas-filled electron tubes, and various insulating materials.

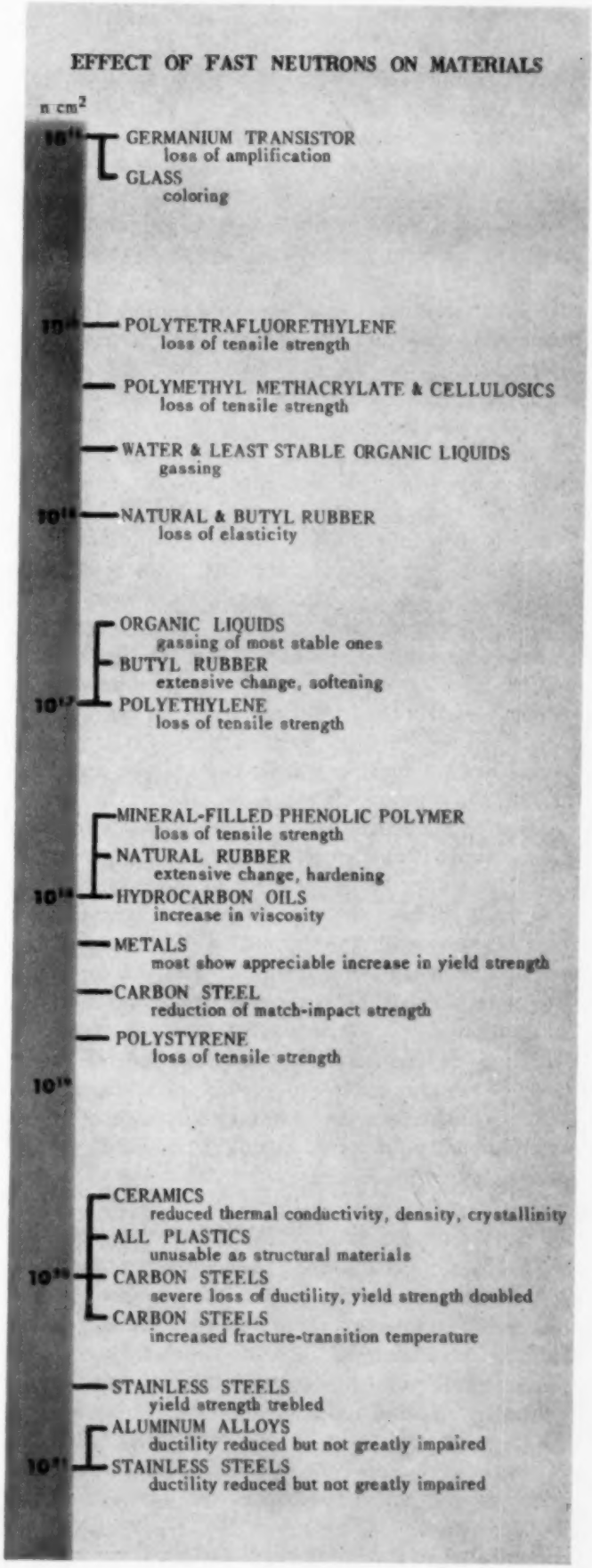
Fast neutrons, being uncharged particles, can lose energy only by direct collision with atoms. Moreover, once a collision has taken place, the atom, in turn, rapidly strikes and displaces other atoms. The results of these collisions are vacancies, interstitials, thermal spikes, impurity atoms, and ionization effects. While not completely understood, all of these effects will cause changes in many of the properties of the material involved. Examples of fast neutron effects are increases in yield strength and decreases in ductility of certain metals and permanent changes in the electrical properties of semiconductor materials.

Except for induced radioactivity, slow neutrons have little direct effect on materials. An exception is the cracking of glass vacuum tube envelopes due to the absorption of the slow neutrons by the boron contained in the glass.

While it is easy to talk about the above effects qualitatively, it is considerably more difficult to quantify radiation effects. The entire field of radiation dosimetry has grown out of this attempt to measure and interpret the radiation dose received by a sample undergoing irradiation. Although the methods of obtaining good dosimetry measurements are both complex and important, it is sufficient here to define two specific units that will be used to discuss gamma and fast neutron irradiation respectively.

(1) *ergs* $g^{-1}(C)$—ergs per gram referred to carbon, equivalent to the energy absorbed from a gamma field per unit mass of carbon (as a reference material). In the case of organic materials this is approximately equal to the energy absorbed per gram of sample.

(2) $n\ cm^{-2}$—unit of integrated flux, the neutron density, $n$, multiplied by the neutron velocity in cm $sec^{-1}$ and the exposure time in seconds.



### Typical Hydraulic Control System

To illustrate what nuclear radiation does to materials, components, and systems, let us consider its effects on a typical hydraulic control system. The figure on page 11 shows a system such as might be used in an aircraft or missile. In its operation, a surface such as a wing or tail is actuated in response to the control input (some signal such as a gyroscope, computer, or manual signal). The control input will be in the nature of an electrical signal which must be amplified so that it may start a series of events that will bring about the desired action. In the case illustrated, the desired action is physically brought about by means of a hydraulic power system. Thus, the amplified signal activates a hydraulic valve which provides a fluid under pressure from the hydraulic power system to the hydraulic actuator. The actuator then mechanically transmits the desired power to the controlled surface. The feedback signal from the controlled surface to the amplifier optimizes the entire system operation.

From the breakdown of system components and materials shown on page 11 one can see that quite a number of electronic and electrical components as well as a variety of organic, metallic, and ceramic materials are used in this system. If this system were placed in an aircraft or missile powered by a nuclear reactor, the components would be exposed, in varying degrees, to nuclear radiation. The radiation effects on the materials, components, and the system itself would affect its ability to perform its intended mission as well as its lifetime and reliability. To determine how such a system might perform in a radiation environment let us look at some of the individual components and materials that might provide the "weak link". We will consider first the two areas most susceptible to radiation damage, namely electrical and electronic components and organic materials. After these areas have been discussed we will look briefly at metals and ceramic materials before taking a final look at the over-all system behavior.

*Electrical and Electronic Components*

The chart indicates that the amplifier circuit may contain such items as: printed circuit boards, semiconductor devices, electron tubes, capacitors, transformers, resistors, and insulation materials.

Printed circuit boards are subject to serious degradation in a radiation environment. Depending on the type of boards used, they exhibit deterioration of the base material, development of leakage paths, and loosening and corrosion of the conductor strips and terminals.

Semiconductor devices in general are more susceptible to radiation damage than most other electronic components. Their use in a stringent nuclear environment ($10^{14}$ to $10^{15}$ fast n $cm^{-2}$) constitutes a problem area. The limiting factors include permanent damage produced by fast neutrons, induced voltages produced by ionizing radiation, high ambient temperatures, and mechanical vibration.

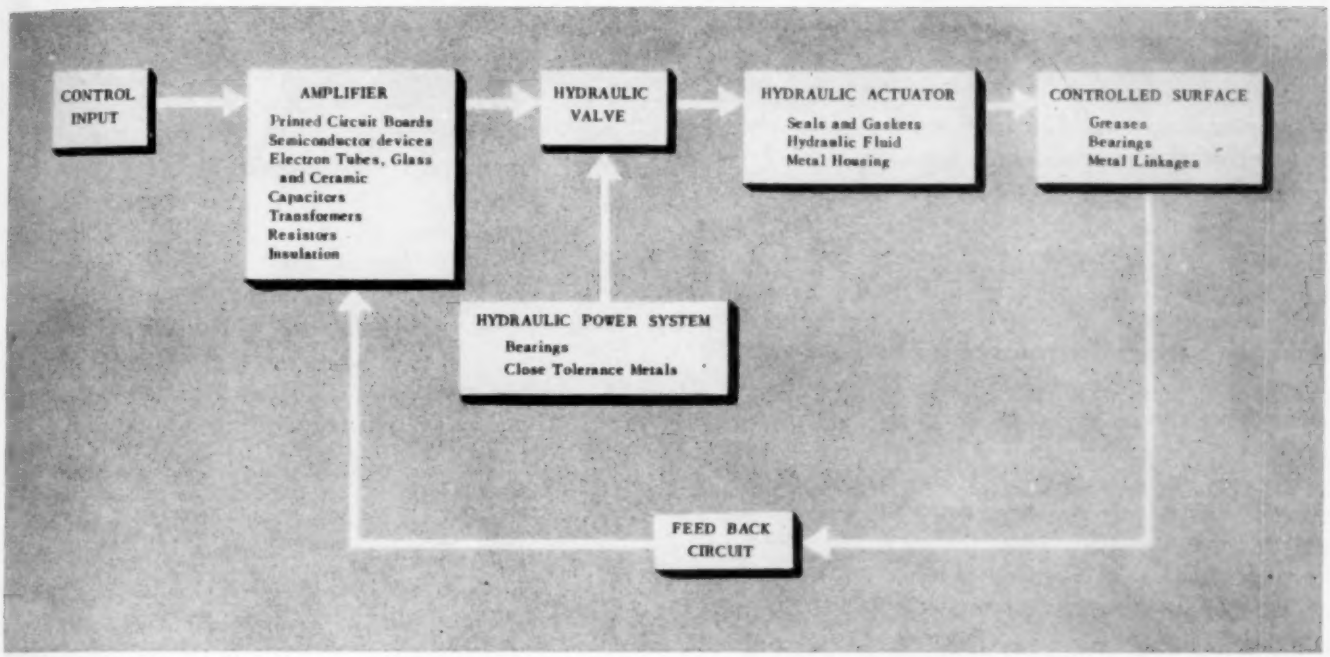
Electron tubes having hard glass (borosilicate) envelopes are not suitable in a radiation field because fractures develop in the glass. Otherwise tube operation does not appear to be affected by exposures to $10^{15}$ fast n $cm^{-2}$. Ceramic encased tubes appear to be capable of operation at extremely high temperatures and may be radiation resistant. However, these tubes are difficult to produce. Photo-tubes develop a transient background current dependent on the radiation intensity.

Ceramic, glass, mica, and Mylar capacitors may be used at fast neutron exposures of $10^{15}$ n $cm^{-2}$ and gamma exposures of $10^{11}$ ergs $g^{-1}(C)$. Plastic, electrolytic, and oil-filled or oil-impregnated capacitors are extremely susceptible to radiation. Oil-filled ca-

As coordinator of the activities of the Radiation Effects Information Center at Battelle, Richard Bowman is familiar with all important studies in that area. Prior to his present responsibilities, he served as editor of the LIQUID PROPELLANTS HANDBOOK in addition to computing the theoretical performance of a number of rocket propellant systems. He has also contributed to studies involving the measurement of vapor pressures of fused-salt systems as well as thermodynamic calculations for various chemical and metallurgical processes. Bowman is active in the Institute of Environmental Sciences and the American Chemical Society.

Carl Lyons, through his association with the Radiation Effects Information Center, has broad familiarity with the subject of the present article. His research interests have also been centered on studies associated with the physical-chemical problems of fuels and with surface chemistry. Among the investigations he has conducted at Battelle have been gas-solid kinetic studies in connection with water-gas reactions, kinetic studies of inorganic reaction systems, and research on the wettability of solids. He has reported the results of these studies in a number of published papers.

## A TYPICAL SYSTEM WITH COMPONENTS AND MATERIALS




pacitors degrade by oil leakage and gas evolution in the neighborhood of $10^{15}$ fast n $cm^{-2}$.

Transformers and wire wound, carbon composition, and film resistors generally are suitable in a radiation environment of $10^{15}$ fast n $cm^{-2}$ and $10^{11}$ ergs $g^{-1}$(C).

The failure of electrical insulation in nuclear-radiation environments is primarily due to the mechanical and physical deterioration of the materials rather than to gross changes in their dielectric properties. The ionizing effects of radiation in organic insulators lead to a series of complex chemical reactions (predominantly crosslinkage or chain cleavage) which drastically alter the nature of the material. The integrated fast-neutron breakdown flux for the most radiation stable of the organic insulators, polystyrene and polyethylene, is estimated to be $10^{20}$ and $10^{19}$ neutrons $cm^{-2}$, respectively. However, elevated temperature tends to hasten the deterioration of organic materials.

Except for glass, the inorganic materials used as insulators are much more radiation resistant than are organic polymers. Damage in ceramic substances arises from atomic displacements and is manifested as changes in the lattice parameters, strength, electrical properties and dimensions. Most ceramic materials are able to withstand integrated fast-neutron fluxes of $10^{22}$ neutron $cm^{-2}$ before they become unsatisfactory as insulators. The radiation damage suffered by ceramic insulators may be annealed out at elevated temperatures.

Both types of materials, organic and inorganic, show strong photoconductive effects when placed in a radiation field. The increased current leakage resulting from this effect may constitute a problem for certain applications of insulators.

From the above discussion it can be seen that the most critical areas for electrical and electronic components are from (1) the presence of materials whose electrical properties are critically determined by crystalline structure (semiconductor devices) and (2) the presence of organic materials which lead to a physical degradation of the system (oil-filled capacitors and organic electrical insulation).

### *Organic Materials*

Referring again to the chart one sees that the seals, the hydraulic fluid, and the bearing grease of our system also will be organic materials. Organic materials, due to their covalent chemical bonds, are among those materials which are most affected by nuclear radiation.

Of the organic materials discussed, the most critical are the elastomers used for sealing. In general, it has been shown that the environment and the use, as well as the composition of the elastomer, have an effect on its radiation stability. Elastomers tend to deteriorate much more rapidly under dynamic test conditions than under static conditions. On the other hand, seals and O-rings exposed in liquid media such as lubricating or hydraulic fluids often have a greater service life under static test condi-

tions than the polymers have indicated when exposed to radiation in air.

Thiokol, nitrile and neoprene perform satisfactorily around $10^9$ ergs $g^{-1}(C)$ at temperatures below 300 F. For temperature above 300 F Viton A and silicones appear to have the best radiation-resistant characteristics of the seal materials tested.

Asbestos-filled phenolics, polystyrene, polyvinyl carbazole and silicone and epoxy glass fiber laminates are unaffected by radiation exposures in the range of $10^{11}$ ergs $g^{-1}(C)$.

Hydraulic fluids composed of alkyl aromatic base fluids are radiation resistant to $5 \times 10^{10}$ ergs $g^{-1}(C)$. Since gas turbine lubricants are composed of the same base stocks as hydraulic fluids their radiation resistance is comparable.

The radiation stability of conventional greases is limited by the gel stability of the thickening agent. Sodium N - octadecylterephthalamate/octylbiphenyl greases show good radiation stability to gamma exposures of $10^{11}$ ergs $g^{-1}(C)$.

*Metals and Ceramic Materials*

Metals do not suffer serious radiation damage when compared to some of the more susceptible nonmetallic materials. The effects of fast neutrons are of primary concern; however, detectable changes in engineering properties do not appear until integrated fluxes of $10^{19}$ fast n $cm^{-2}$. Magnetic properties of some ferrous alloys deteriorate appreciably at integrated fluxes of $10^{17}$ fast n $cm^{-2}$. Radiation effects in metals are generally analogous to the effect of cold work, although the over-all effect is less severe. As in the case of cold work, radiation damage can be repaired or removed by annealing.

The physical and mechanical properties of most ceramic materials (except glass) begin to show slight changes at $10^{18}$ n $cm^{-2}$. All types of glass undergo coloration to some extent and may become useless in optical systems at exposures well below those necessary to change their mechanical properties. As mentioned earlier, radiation damage to glass has resulted in failure of electron tubes, usually by fracture at glass-to-metal seals. Adverse effects on the electrical properties of many ceramics have been noted.

## System Behavior

While the failure of any one of the components of our typical hydraulic control system may serve as the "weak link" and cause system failure, there are certain factors peculiar to the system which must be determined if over-all system reliability is to be obtained. It is because of these factors that it becomes necessary to test the entire system in a radiation environment before one can be certain that it will perform its intended function reliably over the expected lifetime.

Some of these factors to be considered are mentioned briefly as follows:

(1) The dynamic operation of the entire system represents a different set of conditions than either static or dynamic tests of materials and components. One cannot conclude that because all of the components functioned properly in their respective component tests that the entire system will perform properly when irradiated as a unit. For example, the behavior of very close tolerance metal parts such as high speed bearings may have their dimensional properties affected by radiation to cause component failure.

(2) In an electronic system such as the amplifier circuit discussed, one must consider ionization effects on the over-all circuit as well as shielding effects of certain components on other components and selfshielding within a component. Some of these effects may be deleterious whereas others may contribute to the satisfactory operation of the circuit.

(3) The failure of a given component doesn't necessarily mean failure of the entire system. For example, a seal may become embrittled and still maintain its sealing qualities or hydraulic fluid may gas and sludge while the system continues to perform.

## Conclusions

The increasing use of nuclear energy will intensify the search for materials and systems which can perform satisfactorily in a nuclear environment. Combined with this search for radiation resistance will be the search for materials that are simultaneously resistant to temperature, pressure, humidity, acceleration, shock, and vibration. For example, one such problem will be the development of materials that will resist radiation while operating at the cryogenic temperatures that are found in outer space. Such materials will be necessary if we are to utilize nuclear-powered rockets for space missions.

The search for such radiation-resistant materials will undoubtedly uncover improved materials for many other applications. In addition, the study of radiation damage could lead to a better understanding of basic physical and chemical phenomena in materials. Thus, it may be seen that the study and understanding of radiation effects provides one more tool in our harnessing of the power of the atom.

# Writings by STAFF Members

American Institute of Mining, Metallurgical and Petroleum Engineers, Metallurgical Society, *Transactions*, v. 215, no. 4, August, 1959, contains the following writings by staff members:

**The Constitution of Delta-Phase Alloys of the System Uranium-Zirconium-Molybdenum.** M. S. Farkas, A. A. Bauer, and F. A. Rough, pp. 685-693.

A ternary cut joining U-31.5 atomic per cent Mo to U-74 atmosphere per cent Zr is presented on the basis of differential thermal analysis, metallographic and X-ray diffraction data. Hypothetical isothermal ternary sections, inferred from the determined δ-phase relationships, are presented. A ternary eutectoid, at 454 C, was found in zirconium-rich alloys. Its composition, based on metallography and electron-beam microanalysis is estimated as U-61.7 atomic per cent Zr—7 atomic per cent Mo.

**Correlation of Transformation Behavior with Mechanical Properties of Several Titanium-Base Alloys.** A. J. Griest, J. R. Doig, and P. D. Frost, pp. 627-632.

Hardness, tensile, and X-ray diffraction data were compiled to follow the course of aging in the nominal alloys Ti-8Mn, Ti-8Mn-2Al, Ti-4Mn-4Al, Ti-6Al-4V, and Ti-4Fe. The titanium-manganese and titanium-manganese-aluminum alloys were embrittled after quenching from the α-β field and aging for short times at 800 or 900 F. Omega phase patterns at this time were strong for the Ti-8Mn alloy, weaker and more diffuse for the Ti-8Mn-2Al alloy, and were not detected positively for the Ti-4Al-4Mn specimens. Omega was not observed on aging of the Ti-6Al-4V alloy. These data support previous observations that aluminum suppresses the formation of ω phase.

*Journal of Applied Physics*, v. 30, August, 1959, contains the following articles by staff members:

**Radiation-Produced Energy Levels in Compound Semiconductors.** L. W. Aukerman, pp. 1239-1243.

The effects of high-energy radiation on the electrical properties of compound semiconductors are reviewed. Emphasis is placed on those effects which can be interpreted in terms of energy levels. The following compounds are discussed: InSb, InAs, GaSb, AlSb, GaAs, InP, CdTe, and SiC. The implications of bombardment-produced changes in carrier concentration on possible energy levels are considered. Of the compound semiconductors, only InSb, irradiated at 200 K with electrons, has been sufficiently studied to enable a determination of the positions of the energy levels and their rates of generation. The annealing behavior of both InSb and GaSb is complex. A possible interpretation of these annealing characteristics in terms of shifting energy levels is discussed.

**Irradiation Damage in Germanium and Silicon Due to Electrons and Gamma Rays.** Julius H. Cahn, pp. 1310-1316.

The simple model for atomic displacements by electrons of Seitz and Koehler is used to calculate the total number of displaced atoms in Ge and Si due to electrons and gamma rays to energies up to 7 Mev. The calculations are compared to reported experiments in the literature. Electron damage at energies below 1 Mev requires the assumption of threshold energies less than 30 ev, while the higher energy electron damage data are fairly well explained by a 30-ev threshold. The measured gamma-ray cross sections for atomic displacements are an order of magnitude smaller than the calculated cross sections, even for a 30-ev threshold both for Si and Ge.

**Transport Properties in Silicon and Gallium Arsenide.** R. K. Willardson, pp. 1158-1165.

High-purity *n*- and *p*-type Si has been irradiated lightly with Co rays. Analysis of the Hall mobility and magnetoresistance data indicate the introduction of levels near the conduction and valence bands. The analysis suggests the presence of triply ionized acceptors and singly ionized donors. The third ionization state of the acceptor apparently produces a level above the center of the band gap: Under more extensive irradiation a double ionization of the donors can account for the observed high resistivity. An initial increase in the magnetic field dependence of the Hall coefficient in both *n*- and *p*-type Si may be related to the multiple ionization or to radiation annealing. The Hall mobility and transverse magneto-resistance in *n*-type Ga arsenide have been studied as a function of impurity concentration and density of defects introduced by fast-neutron irradiation. The change in the mobility and magnetoresistance with fast edges and of multiple ionized levels similar to those in Si.

**Round-Section Beams.** Charles W. Bert. *Machine Design*, August 20, 1959, pp. 179-181.

Most design problems involve "long" beam members in which bending stresses are of primary concern. In "short" beams, however, such as stub axles and lugs, transverse shear stress may be the controlling consideration. Attention is focused on the application of bars and tubes of circular cross section as beam members. A general design procedure and basic concepts are presented along with simplified criteria for determining whether a beam is "long" or "short".

**Belt, Chain, and Gear Drives.** E. S. Cheaney, C. L. Paullus, and W. C. Raridan. *Machine Design*, August 20, 1959, p. 182 + 8 pages.

Addition of a plastic inner ply in one type of flat belting resulted in marked improvements. The ribbed belt is the successful result of efforts to combine the strength and simplicity of the flat belt with the high grip and positive groove-tracking of the V-belt. Several types of chains and gears are discussed. Design procedures including ratio and speed and the properties and capabilities of belts, chains, and gears are considered. Other points of consideration include ratio accuracy, vibration and noise, efficiency, lubrication, and maintenance requirements.

**Fine Structure in the Hall Coefficient.** A. C. Beer. Paper from *Advances in Semi-Conductor Science. Proceedings of the Third International Conference on Semi-Conductors Held at the University of Rochester, U.S.A., August 18-22, 1958.* Pergamon Press, New York, 1959, pp. 507-511.

Measurements of the Hall coefficient as a function of magnetic field in the extrinsic region of semiconductors such as *p*-type germanium, silicon, diamond, and AlSb, reveal a fine structure consisting of maxima and minima. For *p*-type germanium, the minima occur at a magnetic field strength in the neighborhood of the experimental data at 77 K. In silicon, with a lower mobility ratio between light- and heavy-mass bands, the structure resulting from the warped band is generally not obscured by contributions from the light-mass band, and the maximum is very much in evidence.

**The World's Hottest Alloys. I.** Harry B. Goodwin. *Industrial Research*, v. 1, no. 3, Summer, 1959, p. 20 + 5 pages.

A comprehensive report on progress and possibilities in the development of high temperature alloys including cost and obtainability of important metals.

*Members of the Battelle staff are authors of the recently published articles and books listed on these pages. In most cases, reprints are available from the Battelle Publications Office, 505 King Avenue, Columbus 1, Ohio.*

# NOTES from BATTELLE

## * RADAR COUNTER-MEASURES STUDY

In the event of attack by enemy aircraft, radar, of course, would play a major role in defensive measures against them. However, the effectiveness of radar defenses is seriously limited by electronic counter measures (ECM) that are now available to confuse defense systems.

Little is known about the actual effects of various forms and types of such counter measures upon the systems against which they were designed to operate. As part of the effort to determine such effects, a more than two-year study has been in process for Wright Air Development Center and General Mills, Inc. using simulation and analytical techniques.

John K. Wetherbee and Benjamin B. Gordon, who are guiding the study, report that the physical simulation of the counter-measures environment on an Air Force radarscope has been the basis of the study. Equipment to synthesize the effects of ECM generation had to be developed. However, a general purpose analog computer is used to compute the course of the "enemy aircraft" and its relationship to the defense site, thereby assuring reproducibility of conditions.

The actual generation of the target and counter measures signals is done at radio frequency (RF), with the changes in signal strength (reflecting variations in range between aircraft and defense station) as well as the effective echo area of the "attacking" aircraft being produced by servo-driven RF attenuators in the wave-guide portions of the equipment. The RF signals themselves are generated by standard components tied together to form a simulated radar system. Counter measures signals are generated by equipment developed by General Mills.

The effects are analyzed by using a war-time digital model, which is solved on a general purpose digital computer. With this approach, realistic, repeatable radar and counter-measures presentations make it possible to determine the effects of counter measures upon radar defenses. At the same time, the ability of observers to track targets under various ECM conditions can be studied.

## * FOR FASTER ANALYSES

Speedy techniques of analysis are available for many chemical elements and compounds. The portland cement industry has naturally availed itself of these advanced methods. As a result, most of the quality-control analysis required for portland cement can be completed within four hours. However, one phase of the analysis, for magnesium oxide, currently takes 28 hours for the required digestion, filtration, ignition, and weighing steps.

A recent study, supported by the U. S. Atomic Energy Commission as part of its research on tracer quality-control systems, has led to a radiometric technique that can speed up the analysis of magnesium oxide. This procedure has been developed in a study recently reported by J. E. Howes, Jr., C. T. Brown, M. Pobereskin, D. N. Sunderman and P. Schall.

The analysis—requiring less than one hour—is based on a modification of the basic method outlined by ASTM. The primary change in the latter is the labelling of ammonium monohydrogen phosphate with phosphorus-32. This step enables direct determination of the amount of precipitate formed and eliminates the time-consuming digestion, filtration, ignition, and weighing steps. In a concentration range of 5 to 15 mg of magnesium oxide per 100 ml, accuracy of the results have been within 0.05 per cent when the results are expressed as per cent of magnesium oxide in cement.

Because of the speed, simplicity, and accuracy of the technique, the technologists believe it deserves serious consideration by cement producers.

## * MORE FILMS FOR ELECTRONICS

In the past decade, thin-film technology has improved such electronic components as resistors, potentiometers, photoconductors, resistance thermometers, and even windshield heaters. The improvements have included size reduction, greater precision, and higher speeds as well as

providing benefits such as transparency simultaneously with low resistance.

E. H. Layer reports that studies sponsored by Wright Air Development Center have brought to light additional materials that promise to complement and extend advantages already provided by existing films. Among these materials are certain nitrides, silicides, and oxides.

Of the nitrides studied, according to Layer, chromium-titanium-nitride appeared most promising for resistive applications. By adjusting film thickness and nitriding temperature, resistances of 60 to 800 ohms per square can be obtained. The resistance range can be extended above these values by masking, spiralling, or meandering. Evaluations indicate that the materials possess electrical, physical, and mechanical properties for high-temperature, precision-resistor uses.

Chromium-silicon films appear to be more stable than the nitride films; they do not change appreciably in resistance even when exposed to temperatures of about 500 F for thousands of hours without protection from air. Most interesting were films deposited from 24 per cent chromium and 76 per cent silicon (both weight per cent). Depending upon the temperature of the substrate on which the film is deposited, and the thickness of the film, resistance can be varied from 100 to 10,000 ohms per square. Investigation of chromium-silicon films has not yet been completed.

Indium oxide, when formed as a film, has a resistivity in the range from $10^{-3}$ to $10^{-2}$ ohms-centimeters. Because such films have high transmittance and low resistance characteristics, and are rugged, they are useful as transparent electrodes. They have also been fabricated as transparent heaters. The use of indium-oxide films in the latter application is particularly feasible because they may be applied to substrates without heating film or substrate above 300 F. Thus the films may be applied safely to plastics, for example to plastic-bonded electroluminors, such as are used in electroluminescent applications.

## * LIGHT IN LINSEED OIL OXIDATION

The absorption of oxygen by unsaturated vegetable oils has long been recognized as important in the formation of the polymers that make such oils useful in coatings. Research on the mechanism has shown that the rate of oxygen absorption is affected by heat, catalysts, and light. The effects of heat and catalysts have been extensively studied, but little has been done on the effects of light on the oxidation of unsaturated vegetable oils.

David A. Berry has investigated the relationship of various wave lengths of light in the visible spectrum to the rate of oxygen absorption in linseed oil in which metallic driers had been incorporated. As part of the study, he also determined to what extent the activity of the driers—cobalt, manganese, and lead naphthenates—is influenced by light of various colors.

Berry determined the total oxygen pickup by oil and drier mixtures over a 24-hour period, including the induction period during which oxidation gets under way. He found that the induction period is strongly influenced by both the metal used as a drying catalyst and the color of the light directed upon the oil. The activity of the catalysts was in the expected order—cobalt, manganese, and lead. The technologist found, however, that though manganese has a longer induction period than the other two metals, its oxidation rates are faster once the reaction is initiated.

In the experimentation with lights of various colors, Berry found that the order of activation was generally as follows: blue, white, yellow, green, red, and total darkness. This was the order for oils incorporating manganese and lead. For oils containing cobalt, however, yellow, red, and green lights actually inhibit the oxidation reaction.

## * MINING INDUSTRY AND RESEACH

"There is plenty of room for economic improvement in mining, concentrating, melting, and fabrication operations through the application of research and technology to problems of the nation's mining industry." This was the promise and the challenge offered last month to delegates to the American Mining Congress by David C. Minton, Jr. "Research," he said, "may not be the whole answer for the economic problems of the mining and minerals industries, but it should be a big help."

Conceding that some of the problems faced by the industry are political in origin, Minton insisted that research can still do much to improve the industry's economic position in relation to its counterpart in other countries. The American mining industry, he said, has two major advantages over foreign competition: 1. proximity to the world's best market and 2. a superior technology. The industry could and should use this second advantage to a greater degree through well-planned programs of research. Economies effected through research may appear "trifling compared to

benefits that might be obtained through tariff or import quota actions, but they might make the difference between a modestly successful operation and a falling one during periods of adversity."

The Battelle vice president listed four areas in which technical, economic, and market research could contribute to the betterment of mineral economics: cost reduction, by-product utilization, diversification and integration, and new uses of minerals.

Discussing cost reduction, Minton said that continued mechanization holds the best prospects for cutting costs. The fact that the labor cost per ton of crude ore produced in the United States is lower than in many countries with lower hourly wage scales, he said, "I fear companies which investigate by-product

Use of research to find new by-products has already proved a boon to many mining interests, the speaker said. It could be even more effective, though, if the industry would take a longer look at by-product development. "Current economics usually dictate whether or not a by-product is recoverable, but, too often," he said, "I fear companies which investigate by-product recovery tend to regard the existing economics as immutable."

"Many technical, sociological, and political developments are acting to change the economics constantly, and what is impractical today may be a bonanza tomorrow. . . . Any whim of the American people may create a market for something you have been throwing away. . . . It would seem to me that it would be well worth the investment for a mining company to have up its sleeve at least the rudiments of the technology needed to capitalize on promising by-product situations—ready to spring that technology when the occasion warrants."

Speaking of diversification as a means to improve the economic condition of the mining industry, Minton's main point was that attention should be given to diversification that results in upgrading of basic materials. He reminded Congress delegates that "there is a mark-up on the labor constituent as well as on the materials constitutent, so the total 'take' from a ton of what was rock in the ground is much more." The producer of a basic material must, he said, "diversify, either by offering the material in varied, upgraded forms; by going into the production of intermediates, semimanufactures, or finished consumer products; by exploiting a line of by-products; or by going into exotic business ventures. And to find the diversification opportunities, technical, economic, and market research are needed."

The search for new uses, he cautioned, calls for imagination. "Who would have thought 50 years ago that fly rods and draperies would someday be made of glass? Or that bearings would be made of organic chemicals? Or evening gowns of aluminum? It takes real imagination and persistent research to bring about such transformations. It is hard for me to believe that the uses of copper, zinc, and lead, to name a few of the products of western mines, are so circumscribed that these metals must 'do or die' in their present applications."

* INJECTION AND COMBUSTION OF LIQUID FUELS, a comprehensive guide to literature on fundamental research on liquid-fuels combustion, has been printed and is now being sold by the U. S. Department of Commerce's Office of Technical Services. The 789-page monograph was prepared originally in 1957 as WADC Technical Report 56-344 for Wright Air Development Center.

The monograph covers literature, published through 1956, on liquid-fuels-combustion research. It contains a critical review of material in the unclassified literature relating directly to the fundamental physical phenomena involved in high-intensity combustors and other steady-flow combustion processes. Included are sections on atomization of liquid fuels, ballistics and evaporation of droplets, laminar flame propagation, turbulent flames, premixed flames, stability limits, droplet combustion, diffusion flames, and ignition.

Copies of the second printing, designated Publication BP 13108, may be obtained for $9.00 a copy from the Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C.

* Staff members recently named to important technical posts include: *C. M. Allen,* member, Awards Committee, American Society of Lubrication Engineers; *K. E. Cochran,* representative (for American Institute of Electrical Engineers) to American Standards Association Sectional Committee C-16 (Radio and Electronics Equipment); *B. W. Gonser,* member, Distinguished Lecturer Committee, American Institute of Mining, Metallurgical and Petroleum Engineers; *J. H. Jackson,* chairman, Advisory Committee, JOURNAL OF METALS; *C. A. Snavely,* member, Sub-Committee for Hydrogen Embrittlement Symposium (Los Angeles, June, 1960), American Electroplaters' Society.

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## AERONAUTICAL ENGINEERING

**11164 Interplanetary Travel by Solar Sail.** Characteristics of a solar sail are examined, the equations of motion solved, the sail tilt angle optimized, the time of travel computed, and the performance compared with that of chemical-rocket and ionic propulsion systems. ***T. C. Tsu.*** *ARS Journal*, v. 29, June 1959, p. 422-427.

**11165 Prediction Theory of Missile and Satellite Orbits.** Presents equations applicable to radio detection of an ICBM or reconnaissance satellite and preliminary prediction of its path and impact point. A necessary and sufficient condition is derived for deciding whether or not the object is moving in a gravitational orbit. ***W. J. Berger and J. R. Ricupito.*** *ARS Journal*, v. 29, June 1959, p. 428-432.

**11166 Explorer Rocket Research Program.** Nine Jupiter-C missiles have been launched at Cape Canaveral since September, 1956. The first three tested propulsion system, airframe, guidance components, and re-entry conditions of the nose cone; the remaining six were used as carriers of the Explorer satellites I through VI. Jupiter-C is a four-stage vehicle burning solid propellant. Satellite payloads of the Explorer series were contained in a shell 80-in. long by 6 in. in diameter, which, together with its package of instruments for Explorer I, weighed 30.8 lb. Explorer IV achieved a perigee altitude of 160 miles and an apogee altitude of 1390 miles. ***G. Robillard.*** *ARS Journal*, v. 29, July 1959, p. 492-496.

**11167 General Solution for Optimization of Staging of Multistaged Boost Vehicles.** Investigation based upon weight-dependent criteria. Optimization may be in terms of any criterion that can be expressed as proportional to stage or step weight, such as cost, volume, empty and propellant wt., as well as the usual criterion of gross wt. Solution is applicable to a vehicle of any number of stages having different performances and characteristics. The possibility of stages with variable performance, such as an air-breathing engine stage, is included. ***Carl H. Builder.*** *ARS Journal*, v. 29, July 1959, p. 497-499.

**11168* Producibility Study—F-108, B-70.** How NAA will build Mach 3 aircraft. "Best" materials and methods. ***Philip Geddes.*** *Aircraft and Missiles Manufacturing*, v. 2, Aug. 1959, p. 26-31.

**11169* Integration of Boundary Layer Equations.** A method is given for calculation of the boundary layer described by means of linear differential equations in partial derivatives for solution of boundary value problems. The functions determined do not depend upon pressure gradient and can be checked for any ambient contour. (*In Russian.*) Ob integrirovanii uravnenii pogranichnogo sloia. ***V. Ia. Shkadov.*** *Akademiia Nauk SSR, Doklady*, v. 126, no. 4, June 1, 1959, p. 730-732.

**11170 Mechta Radiation Data.** Russia's heavily instrumented lunar probe has yielded quantitative data on cislunar corpuscular radiation, as well as the Great Radiation Belt. ***S. N. Vernov, A. Ye. Chudakov, P. V. Vakulov, and Yu. I. Logachev.*** *Astronautics*, v. 4, July 1959, p. 23 + 3 pages.

**11171 Pioneer's Radiation-Detection Instrument.** Electrical system, schematic, and other pertinent data. ***Conrad Josias.*** *Astronautics*, v. 4, July 1959, p. 32 + 3 pages.

**11172 Drag Brake for Manned Satellite Recovery.** Umbrella-like steel drag brake offers high reliability, simple control, and less weight than comparable retrorocket systems. ***R. W. Detra, A. R. Kantrowitz, F. R. Riddell, and P. H. Rose.*** *Astronautics*, v. 4, July 1959, p. 34 + 5 pages.

**11173 Next Decade in Space. Special Report on NASA Programs.** U. S. space programs, plans, goals; engines as key to space timetables; manned orbital flight; planetary flight; science programs to probe universe; operational satellite network; mercury network tracking needs; industry in space work. *Aviation Week*, v. 70, June 22, 1959, p. 119-154.

**11174* Estimation of Aircraft Fatigue Life.** Presents a simplified method of calculating the life expectancy of an aircraft. Using the analyses of Chilver and Harper as bases, a

*Asterisks mark items that may be used in the Battelle Library only. None of the unbound materials listed are available for interlibrary loan.

simple formula is derived for the damage per mile. ***E. Aubrey and B. Venkatraman.*** *Canadian Aeronautical Journal,* v. 5, no. 6, June 1959, p. 207-214.

**11175* Hydraulics for a High Performance Aircraft—Why and How.** Requirements; flight control system; utility system. Problems in hydraulic systems design including choice of fluid, tube connections, reservoir design, temperature problem, filter arrangement, and the future of hydraulics. ***D. Royston.*** *Canadian Aeronautical Journal,* v. 5, no. 6, June 1959, p. 233-242.

**11176 A Theory of the Response of Airplanes to Random Atmospheric Turbulence.** Theory is given for the aerodynamic forces and moments which act on an airplane as a result of flight through turbulent air, and for the associated dynamic response of the airplane. It starts with Ribner's spectral theory of the phenomenon, and extends it to a specific formulation of the forces and moments. ***B. Etkin.*** *Journal of the Aero/Space Sciences,* v. 26, July 1959, p. 409-420.

**11177 Laminar Heat Transfer Around Blunt Bodies in Dissociated Air.** Method of predicting laminar heat-transfer rates to blunt, highly cooled bodies with constant wall temperature in dissociated air flow is developed. Attention is restricted to the case of axisymmetric bodies at zero incidence. Experimental heat-transfer rates obtained with correct stagnation-point simulation and high wall cooling in shock tubes are also presented and compared with the theoretical predictions. ***Nelson H. Kemp, Peter H. Rose, and Ralph W. Detra.*** *Journal of the Aero/Space Sciences,* v. 26, July 1959, p. 421-430.

**11178 On the Rotational Motion of a Body Re-Entering the Atmosphere.** Exact equations of motion of a body acted upon by aerodynamic and gravitational forces are formulated, using inertial axes fixed in a spherical, nonrotating earth. With the assumption that the spin rate of the vehicle is constant and of such a magnitude that Magnus forces may be ignored, expressions are developed for the applied forces and moments of forces. Stability of the oscillations is examined, and the conclusion is drawn that the oscillations are bounded for a statically stable, spinning vehicle. ***T. B. Garber.*** *Journal of the Aero/Space Sciences,* v. 26, July 1959, p. 443-449.

**11179 Laminar Boundary Layer With Suction and Injection.** With the assumptions of a heat insulated body, a Prandtl number of unity, and a linear temperature-viscosity relation, the axisymmetric equations governing a given high-speed compressible flow are reduced to equations describing an incompressible two-dimensional flow past a flat plate with a determinable main stream and normal wall velocity distribution. ***R. J. Gribben.*** *Physics of Fluids,* v. 2, no. 3, May-June 1959, p. 305-318.

**11180 Combined Forced and Free Convection in a Boundary Layer Flow.** Analysis of flow and heat transfer about a nonisothermal body subjected to a nonuniform free stream velocity. ***E. M. Sparrow, R. Eichhorn, and J. L. Gregg.*** *Physics of Fluids,* v. 2, no. 3, May-June 1959, p. 319-328.

**11181* Nuclear Ion Rocket Can Make Space Ships Practical.** ***Victor P. Kovacik and Daniel P. Ross.*** *SAE Journal,* v. 67, July 1959, p. 40-42.

**11182* Just a Few Changes Would Make the Turbine Engine an Admirable Powerplant for VTOL Aircraft.** ***James A. O'Malley, Jr. and Arthur M. Jackes.*** *SAE Journal,* v. 67, July 1959, p. 43.

**11183* Low-Density Research.** Studies of aerodynamic objects and models in low density atmosphere at supersonic speeds up to Mach 4 in a UTIA tunnel. ***J. B. French, E. O. Gadamer, S. A. Gordon, and E. P. Muntz.*** *Shell Aviation News,* 1959, no. 252, June, p. 14-17.

**11184 Sounding Rockets.** Describes some of the modern rockets that have been used in scientific research of the upper atmosphere and the sun. ***Homer E. Newell, Jr.*** 334 pp. 1959. McGraw-Hill, New York. (TL782 N44s)

**11185 Soviet Space Science.** Survey of U.S.S.R. achievements and plans for the future. ***Ari Shternfeld.*** 361 pp. 1959. Basic Books, Inc., New York. (TL796 Sh88i2tr)

**11186* Determining Lunar Mission Guidance Requirements.** Trajectory analyses are used to specify cutoff parameter accuracies. ***Benjamin M. Rosen.*** *Sperry Engineering Review,* v. 12, no. 2, June 1959, p. 27-33.

**11187 Sputnik Into Space.** Nontechnical exposition of present and future Russian space vehicles. ***M. Vassilier.*** 181 pp. 1958. Dial Press, New York. (TL790 V44ptr)

**11188 Solar Sailing.** Methods for propelling objects through space by using the pressure of the sun's radiation. ***Theodore P. Cotter.*** *U. S. Atomic Energy Commission,* SCR-78, Apr. 1959, 18 pp. (UF767 Un3.1scr Contin.)

## AGRICULTURE

**11189* A Study of Insecticide Resistance in House Flies of Germany and France.** Strains from nine areas of Germany and France were laboratory tested to determine their susceptibility to DDT, lindane, dieldrin and malathion by topical application in acetone solutions. All strains were derived from flies which were collected in the field and reared in the laboratory until several successive generations had been tested. All strains tested were found to be significantly resistant to DDT. Similarly five strains showed a moderate degree of resistance to lindane and five to dieldrin. None were shown to be significantly resistant to malathion. ***Joseph E. Webb, Jr.*** *Journal of Economic Entomology,* v. 52, no. 3, June 1959, p. 419-421.

**11190* The Effect of Several Insecticides on the Total Arthropod Population in Alfalfa.** Sprays containing parathion, malathion, demeton, endrin or toxaphene applied to alfalfa caused marked reductions of the total arthropod populations. Reductions were greater for the phytophagous species as a group than for the entomophagous species. Parathion was the most toxic to some of the beneficial species and endrin was the least toxic. ***F. A. Fenton.*** *Journal of Economic Entomology,* v. 52, no. 3, June 1959, p. 428-432.

**11191* Rotational Use of Spray Chemicals in Insect and Mite Control.** Data secured from apple growers' spray schedules and from orchards sprayed with various experimental spray chemicals show that the development of resistance by orchard mites can be greatly retarded and possibly prevented entirely by the rotational use of spray chemicals with different killing actions. ***C. R. Cutright.*** *Journal of Economic Entomology,* v. 52, no. 3, June 1959, p. 432-434.

**11192* On the Improbability of *Bacillus thuringiensis* Berliner Mutating to Forms Pathogenic for Vertebrates.** On the basis of theoretical considerations, as well as experimental evidence, there appears to be little reason to believe that crystalliferous *Bacillus thuringiensis* Berliner and its close varieties as they occur in properly prepared microbial insecticides are likely to mutate spontaneously into forms pathogenic for vertebrates. ***Edward A. Steinhaus.*** *Journal of Economic Entomology,* v. 52, no. 3, June 1959, p. 506-508.

**11193* Micronutrient Content of Phosphorus Fertilizers.** ***Frank T. Bingham.*** *Soil Science,* v. 88, no. 1, July 1959, p. 7-10.

## BIOCHEMISTRY AND BIOPHYSICS

**11194* On the Intramolecular Location of Deoxyribonucleotides Incorporated Into Deoxyribonucleic Acid by Extracts of Ascites Tumour Cells.** It is concluded that the incorporation of thymidine represents synthesis of a new portion of a polynucleotide chain. ***E. D. Gray and R. M. S. Smellie.*** *Biochemical Journal,* v. 72, no. 2, June 1959, p. 16.

**11195* Long-Term Mixed Cultures of Human Hemic Cells, With Granulocytic, Lymphocytic, Plasmocytic and Erythrocytic Series Represented.** New culture strains containing human hemic cells of monocytic, lymphocytic, granulocytic, plasmocytic, and erythrocytic series are described with suggestions as to maintenance of the desired cell series in culture. A high population density must be maintained in cultivation of the mixed cultures or the desired cell type may be lost. ***John***

***H. Brooke and Edwin E. Osgood.*** *Blood*, v. 14, July 1959, p. 803-815.

**11196* Antibodies Against Nuclear and Cytoplasmic Cell Constituents in Systemic Lupus Erythematosus and Other Diseases.** Previous observations of Robbins, Holman, Deicher, and Kunkel (1957), on the occurrence of complement fixing antibodies against nuclei and desoxyribose nucleic acid in the sera of patients with systemic lupus erythematosus have been confirmed. Some patients with lupoid hepatitis, primary biliary cirrhosis, macroglobulinaema, and syphilis reacted with cytoplasmic antigens, but none reacted with nuclei. ***G. L. Asherson.*** *British Journal of Experimental Pathology*, v. 40, no. 3, June 1959, p. 209-215.

**11197* The Peptide Structure and Its Importance for Catalytic and Biochemical Processes. I. The Importance of the Peptide Configuration for Catalytic and Photochemical Processes. II. Surface Structure and Inclusion Systems. III. Surface Structure and Steric Specificity.** (*In German.*) Peptidstruktur und ihre Bedeutung für katalytische und biochemische Vorgänge. I. Die Bedeutung der Peptidkonfiguration für katalytische und photochemische Vorgänge. II. Oberflächenstruktur und Einschlusssysteme. ***W. Lautsch, et al.*** III. Oberflächenstruktur und sterische Spezifität. ***W. Lautsch and D. Heinicke.*** *Chimia*, v. 13, no. 5, May 1959, p. 129-155.

**11198* Histamine and Cancer Formation by Means of Chemical Organic Substances.** A survey of studies showing that the histamine existing at the end of the nerve nets is fixed by cancerogenic substances. This fixation modifies the relative amount of the chemical intermediaries in the protoplasm of the neurons, which could explain the growth disorder exhibited by cancer. (*In French.*) Histamine et cancérisation par les substances chimiques organiques. ***Simone Hatem.*** *Chimia*, v. 13, no. 5, May 1959, p. 158-160.

**11199 The Enzymes.** Presents the available information about enzymes and enzyme action on a molecular level. A complete revision of the previous edition has been made. Major topics in the present volume include: enzyme kinetics, thermodynamics and mechanism of enzymic catalysis, structural and stereospecificity, enzyme models, mechanisms of transfer enzymes, protein structure and enzyme activity, sulfhydryl and disulfide groups of enzymes, induced formation of enzymes, and control of enzyme activity. ***Paul D. Boyer, Henry Lardy, and Karl Myrbäck, editors.*** v. I. 2nd Ed., 785 pp. 1959. Academic Press Inc., New York. (QP601 En99)

**11200* A Family Study of the So-called Blood Group Chimera.** The authors found a very rare case of a man having two kinds of blood cells of group A and O. Four out of his seven children had the same two kinds of blood cells as their father. The mother of the seven children had the blood group O. ***Tanemoto Furuhata, Mutsuo Kitahama, and Teruo Nozawa.*** *Japan Academy, Proceedings*, v. 35, no. 1, Jan. 1959, p. 55-57.

**11201* Foam Fractionation of Proteins: Concentration of Aqueous Solutions of Bovine Serum Albumin.** ***Robert W. Schnepf and Elmer L. Gaden, Jr.*** *Journal of Biochemical and Microbiological Technology and Engineering*, v. 1, no. 1, Feb. 1959, p. 1-11.

**11202* Similarity of the Structure of DNA From a Variety of Sources.** DNA's from diverse cells of different species and from diverse tissues give the same X-ray diffraction pattern. The presently observable structure of DNA appears, then, to be the same in all cells. It is clear from the general characteristics of the pattern that much of the DNA bound to protein in these nuclei has the usual helical configuration, and that the double-helical structure of DNA exists in the cell and is not an artifact. ***L. D. Hamilton, et al.*** *Journal of Biophysical and Biochemical Cytology*, v. 5, no. 3, May 25, 1959, p. 397-403 + 8 plates.

**11203* The Metabolism of Chromosomal Ribonucleic Acid in *Drosophila* Salivary Glands and Its Relation to Synthesis of Desoxyribonucleic Acid.** RNA-$C^{14}$ and DNA-$C^{14}$ were detected as the fractions extractable by ribonuclease digestion and resistant to ribonuclease, respectively. In the latter part of the period of observation, morphological differentiation of the gland occurred, the decrease in RNA-$C^{14}$ became very rapid, and a large increase in DNA-$C^{14}$ was observed. During this later period, a large decrease in RNA-$C^{14}$ amount occurs suddenly, and the same amount of $C^{14}$ is added simultaneously to the DNA fraction, as expected if RNA-$C^{14}$ is utilized in the synthesis of DNA. ***Rachel McMaster-Kaye and J. Herbert Taylor.*** *Journal of Biophysical and Biochemical Cytology*, v. 5, no. 3, May 25, 1959, p. 461-467.

**11204* An Electron Microscope Study of Myelin Figures.** In the electron microscope, thin sections of $OsO_4$-fixed myelin figures from the phospholipide fraction of human brain show a pattern of parallel dark lines with a repeating period of about 40 A. It is shown that the dark lines probably represent the reaction product of $OsO_4$ with double bonds in the fatty acid chains, thereby marking the central portion of one bimolecular lamella. The addition of globin results in dense lines 25 to 50 A wide that cover the surface of the myelin figures. ***Walter Stoeckenius.*** *Journal of Biophysical and Biochemical Cytology*, v. 5, no. 3, May 25, 1959, p. 491-500 + 8 plates.

**11205 Native Tobacco Mosaic Virus Protein of Molecular Weight 18,000.** The present work provides the first direct experimental evidence for the existence of a native sub-unit of tobacco mosaic virus protein with a molecular weight agreeing with the value of 18,000 postulated in the interpretation of X-ray diffraction patterns. ***Allen T. Ansevin and Max A. Lauffer.*** *Nature*, v. 183, June 6, 1959, p. 1601-1602.

**11206 Persistence of Cholesterol-4-$^{14}$C in the Central Nervous System.** Experiments support the view that the cholesterol that persists in the central nervous system remains metabolically inert for more than a year. ***A. N. Davison and Martha Wajda.*** *Nature*, v. 183, June 6, 1959, p. 1606-1607.

**11207 Structure of Poliomyelitis Virus.** It was found that the packing of the virus particles is somewhat different from that suggested by earlier workers. Concerning the substructure of the individual virus particle the number and type of arrangement of protein sub-units in the particle were determined. X-ray photographs show for the first time in a virus investigation a degree of crystal perfection comparable with that of the lower molecular weight crystalline proteins. ***J. T. Finch and A. Klug.*** *Nature*, v. 183, June 20, 1959, p. 1709-1714.

**11208 Variation of Sensitivity to Ionizing Radiation With Age.** Results show that there is a considerable variation of sensitivity to radiation with age throughout life, and that sensitivity is greatest at a young age. None of the theories which have been put forward to explain the effects of radiation accounts for this variation. ***M. L. Crosfill, Patricia J. Lindop, and J. Rotblat.*** *Nature*, v. 183, June 20, 1959, p. 1729-1730.

**11209* The Effect of Antimitotic Substances (Degranol, Sanamycin, Ether) on the Formation of Antibodies.** The formation of antibodies was retarded by Sanamycin and Degranol and by narcosis with ether. (*In German.*) Die Wirkung von antimitotischen Substanzen (Degranol, Sanamycin, Aether sulfuricus) auf die Antikörperbildung. ***Cs. Hadnagy, A. Kapusi, E. Szentkirályi, I. Krepsz, and D. Szilagyi.*** *Naturwissenschaften*, v. 46, no. 10, May 1959, p. 359.

**11210* The Lubrication of Animal Joints.** Experiments have shown that the biological lubricant for the sliding surfaces of joints—the synovial fluid—will not lubricate artificial joints. They must be constructed, therefore, from substances having a low coefficient of dry friction. Encouraging results have been obtained with a plastic. ***John Charnley.*** *New Scientist*, (Emergency Issue), v. 6, July 9, 1959, p. 60-61.

**11211 Recent Progress in Hormone Research.** The published proceedings of the Laurentian Hormone Conference, 1958. Major subjects discussed are: the pituitary hormones, aspects of steroid chemistry and metabolism, aldosterone chemistry and physiology, and hormones and metabolism. ***Gregory Pincus, editor.*** v. XV. 504 pp. 1959. Academic Press, New York. (QP801.H7 R24 Vis.)

**11212 A *Symposium* on the Chemical Basis of Heredity.** Papers are collected under the following headings: cellular units of heredity, role of the nucleus, nucleic acids and associated structures in cell division and protein synthesis, nucleic acids as tranforming agents, viruses as bearers of heritable char-

acteristics, nucleic acids—chemical composition and structure, synthesis of nucleotides and nucleic acids, and mechanism of duplication. ***William D. McElroy and Bentley Glass, editors.*** 1957. The Johns Hopkins Press, Baltimore. (QH431 Sy68c)

**11213* Attempted Long-Term Culture of Human Bronchial Mucosa and Bronchial Neoplasms.** Fragments of adult human bronchial tissue have been maintained in tissue culture for long periods. The epithelial mucosa may retain its ciliary activity for as long as 135 days. In contrast to the behavior of normal ciliated epithelium, bronchogenic (chiefly squamous-cell) carcinomas have resisted not only propagation but also attempts at long-term survival, by tissue-culture techniques. ***Relda Cailleau, T. Timothy Crocker, and David A. Wood.*** *U. S. National Cancer Institute, Journal,* v .22, no. 6, June 1959, p. 1027-1038 + 2 plates.

***See also:*** **11353** (penicillin synthesis); **11543** (electroencephalograph).

## CERAMICS AND CONCRETE

**11214 Analysis of a Compression Test of a Model of a Granular Medium.** Prediction of the variation of strain with stress in an axial compression test of a granular bar. ***C. W. Thurston and H. Deresiewicz.*** *ASME, Transactions, Series E, Journal of Applied Mechanics,* v. 26, no. 2, June 1959, p. 251-258.

**11215 A Survey of Ceramic-to-Metal Bonding.** ***G. R. Van Houten.*** *American Ceramic Society Bulletin,* v. 38, June 1959, p. 301-307.

**11216 Thoria Reinforced by Metal Fibers.** Thoria compacts containing refractory metal fibers in quantities as low as 5% have considerably better resistance to thermal shock spalling than $ThO_2$ alone. Of the metals and alloys investigated, Mo and Nb gave best results. Compacts incorporating fibers of these metals have lower elastic moduli and compressive strengths and higher thermal conductivity than $ThO_2$. Oxidation-resistance of Mo fiber-reinforced $ThO_2$ is the best of all combinations investigated. ***Y. Baskin, C. A. Arenberg, and J. H. Handwerk.*** *American Ceramic Society Bulletin,* v. 38, July 1959, p. 345-348.

**11217 Ceramic Fuel Testing by Autoradiography.** A simple and rapid technique is described for measuring the homogeneity of ceramic nuclear fuels containing urania, both normal and enriched, in a stable matrix such as fused alumina or stainless steel. Autoradiographs can be made and evaluated using emission spectrographic equipment and wet chemical analyses. ***C. M. Jones, II, and R. H. Benson.*** *American Ceramic Society Bulletin,* v. 38, July 1959, p. 349-351.

**11218 Applications of Special Refractories in the Aluminum Industry.** Specific properties of ceramic- and nitride-bonded silicon carbide, fused-cast alumina, and high-temperature, ceramic-fiber products are related to applications within the Al industry. These properties indicate a new field of usage for bonded- and fused-cast refractories in reduction cells. ***R. W. Brown and C. R. Landback.*** *American Ceramic Society Bulletin,* v. 38, July 1959, p. 352-355.

**11219 Refractories for Aluminum Melting Furnaces.** A laboratory reaction test is described, and examples are given of the attack of an Al alloy on refractories of many types. ***Donald F. Stock and James L. Dolph.*** *American Ceramic Society Bulletin,* v. 38, July 1959, p. 356-360.

**11220 Oxidation of $UO_2$ to $U_3O_8$.** The oxidation, at temperatures below 500 C, of uranium dioxide to triuranium octaoxide is shown to proceed through the formation of the stable intermediate compound, triuranium hepta-oxide. Experimental data indicate that $U_3O_7$ is the only true Daltonide compound existing in the range: $UO_2$ to $U_3O_8$. ***R. E. DeMarco, H. A. Heller, R. C. Abbott, and W. Burkhardt.*** *American Ceramic Society Bulletin,* v. 38, July 1959, p. 360-362.

**11221 Devitrification of High-$SiO_2$ Glasses of the System $Al_2O_3$-$SiO_2$.** Technique for preparation of experimental glasses of high purity and chemical homogeneity. Devitrification growth-rate and traction-viscosity data. Glasses with added $Al_2O_3$ were found to devitrify to cristobalite more rapidly than ultrapure silica glasses at a given temperature, and yet their fluidities were found to be less. ***S. D. Brown and S. S. Kistler.*** *American Ceramic Society, Journal,* v. 42, June 1959, p. 263-270.

**11222 Dielectric and Structural Studies in the Systems $Ba(Ti,Nb)O_3$ and $Ba(Ti,Ta)O_3$.** Dielectric properties, lattice parameters, and X-ray and neutron diffraction intensities of solid solutions of $BaTiO_3$ containing Nb or Ta were studied. These solid solutions exhibit a remarkable lowering of the Curie point, but the tetragonal-orthorhombic and the orthorhombic-rhombohedral transition points are raised. ***E. C. Subbarao and G. Shirane.*** *American Ceramic Society, Journal,* v. 42, June 1959, p. 279-284.

**11223 The Systems BaO-SrO-$TiO_2$, BaO-CaO-$TiO_2$, and SrO-CaO-$TiO_2$.** Solid phases formed at 1400 C in air are described. Dielectric constants loss factors and crystallographic data are given. The preparation of the new compounds is described in detail. ***W. Kwestroo and H. A. M. Paping.*** *American Ceramic Society, Journal,* v. 42, June 1959, p. 292-299.

**11224 Thermal Expansion of $Al_2O_3$, BeO, MgO, $B_4C$, SiC, and TiC Above 1000°C.** ***Charles J. Engberg and Ernest H. Zehms.*** *American Ceramic Society, Journal,* v. 42, June 1959, p. 300-305.

**11225 Silica-Uranium Fuel Systems.** Irradiation results on two U-silica systems: a U oxide-Vycor-brand glass system and a 10% U oxide glass prepared by melting. The glasses were irradiated up to 15% depletion of the U at temperatures up to the softening points with no appreciable loss of fission-product gases. ***W. M. Cashin.*** *American Ceramic Society, Journal,* v. 42, July 1959, p. 328-329.

**11226 Effects of Viscosity and Stress Level on Rates of Stress Release in Soda-Lime, Potash-Barium, and Borosilicate Glasses.** ***D. A. McGraw and C. L. Babcock.*** *American Ceramic Society, Journal,* v. 42, July 1959, p. 330-336.

**11227 Study of Surface Durability of Container Glasses.** After containers were exposed to a controlled cyclic-humidity test, the durability of their outside and inside surfaces was evaluated. The results indicated that the smaller the opening of the container, the greater was the deterioration of the interior surface. ***H. E. Simpson.*** *American Ceramic Society, Journal,* v. 42, July 1959, p. 337-343.

**11228 Electromechanical Properties of Lead Titanate Zirconate Ceramics Modified With Certain Three- or Five-Valent Additions.** When small amounts of lanthana, neodymia, niobia, or tantala are added to lead titanate zirconate compositions near the morphotropic (rhombohedral-tetragonal) phase boundary, the modified ceramics show piezoelectric planar coupling coefficients of about 0.50 and substantially increased dielectric constants of up to 1545. ***Frank Kulcsar.*** *American Ceramic Society, Journal,* v. 42, July 1959, p. 343-349.

**11229 Dielectric Absorption in Ferroelectric Titanates.** Dielectric absorption currents in ceramic $Ba_{0.72}$-$Sr_{0.28}TiO_3$ (Curie point 48 C) were measured from 7.5 seconds to 2 hours and from room temperature to 91 C. ***Fielding Brown.*** *American Ceramic Society Journal,* v. 42, July 1959, p. 350-354.

**11230* Effect of Powdered Minerals and Fine Aggregate on the Drying Shrinkage of Portland Cement Paste.** Water and powdered admixture contents of the paste were varied both separately and simultaneously, and the effect of gradually increasing the size of the powdered mineral grains until the admixture became an aggregate was studied. Results show that if the Portland Cement in a paste is partially replaced by powdered basalt of cement fineness, and at a constant water-(cement + admixture) ratio, the effect on drying shrinkage represents a balance between individual contributions arising from the simultaneous changes in the water-cement and admixture-cement ratios. ***Kenneth M. Alexander and John Wardlaw.*** *American Concrete Institute, Journal,* v. 30, *ACI Proceedings,* v. 55, no. 12, June 1959, p. 1303-1316.

**11231* Effect of Surface Condition on the Initiation of Plastic Flow in Magnesium Oxide.** ***R. J. Stokes, T. L. Johnston, and C. H. Li.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 3, June 1959, p. 437-444.

**11232* Discontinuous Shrinkage of Hardened Portland Cement Pastes and Mortars, Subjected to Continuous Drying.** Experiments are described which show that when water is lost continuously from hydrated Portland Cement pastes and mortars the resulting shrinkage takes place in two stages. Total water in these pastes and mortars should therefore be considered as stage I evaporable water, stage II evaporable water, and non-evaporable water. If the period of water curing which precedes drying operation is increased, proportions of non-evaporable water and stage II evaporable water increase at the expense of stage I evaporable water. ***K. M. Alexander and J. Wardlaw.*** *Australian Journal of Applied Science*, v. 10, no. 2, June 1959, p. 201-213.

**11233* Acceleration of the Set of Gypsum Plaster.** Accelerated reactions divided into two groups, namely (I) those in which the induction period was reduced but the effect in the maximum rate was comparatively small and (II) those in which the induction period was reduced, and there was a marked increase in the maximum rate. Suggested explanation is made of variations in rate of setting of different samples of plaster. ***M. J. Ridge.*** *Australian Journal of Applied Science*, v. 10, no. 2, June 1959, p. 218-231 + 2 plates.

**11234 The Effect of Additions on the Sintering and Dead-Burning of Magnesia.** The influence of CaO, $Fe_2O_3$, $TiO_2$, $Al_2O_3$, $SiO_2$ and certain melt-forming additions such as dicalcium ferrite and brownmillerite were investigated as a function of the time and temperature of sintering and of the quantity of the addition. Attempt was made to interpret the results in terms of current theories of diffusion-controlled sintering in solids and it is suggested that $TiO_2$, $Al_2O_3$, and $SiO_2$, like $Fe_2O_3$, all promote sintering by providing altervalent cations which are capable of entering the periclase lattice with the creation of cation vacancies. ***H. J. S. Kriek, W. F. Ford, and J. White.*** *British Ceramic Society, Transactions*, v. 58, Jan. 1959, p. 1-34.

**11235 A Note on Grain Growth in Fabricated Beryllia.** The non-uniform "cannibal" grain growth in sintered or hot-pressed BeO is shown to arise from the use of powders having a wide particle-size distribution. Comparison of the microstructures of sintered and hot-pressed specimens shows that the use of an external pressure at constant time-temperature conditions results in a considerable increase in the grain size of the structure. ***I. Denton and P. Murray.*** *British Ceramic Society, Transactions*, v. 58, Jan. 1959, p. 35-39.

**11236 Measurements of the Thermal Transmittance of External Walls by a Guarded Hotplate Method.** Measurements were made of heat transfer through masonry under normal conditions of exposure to the weather. The method takes into consideration the influence of moisture content of the masonry components and shows the inadequacy of existing information on the thermal properties of building materials. ***A. Dinnie, R. Beard, and R. Richards.*** *British Ceramic Society, Transactions*, v. 58, Feb. 1959, p. 113-143.

**11237* Development of Bond Strength During Firing. A New Approach and Its Technical Implications.** An attempt was made to follow the progress of vitrification indirectly by measuring the changes in hot compressive strength which occur during the heating up of initially unfired test-pieces and also during cooling from selected firing-temperatures. Two types of silica brick, two of sillimanite, two of firebrick, one magnesite, and one chrome-magnesite brick were investigated. Implications of the results from the viewpoint of the behavior of fired and unfired refractories in service is discussed. ***D. H. Houseman and J. White.*** *British Ceramic Society, Transactions*, v. 58, May 1959, p. 231-276.

**11238 Advancements in Technical Ceramics. "High K Capacitors".** *Ceramic Age*, v. 74, no. 1, July 1959, p. 30-33.

**11239 Oil Carburation and the Importance of the Produced Gases for Furnace Operation.** It was proven that gases with a high content of hydrocarbons are especially qualified for use in ceramic furnaces, because of their good heat transfer and their chemical ability for reduction. Such gases can be produced by oil carburation. (*In German.*) Ölvergasung und die Bedeutung der so erzeugten Gase für den Ofenbetrieb. ***C. Hilgers and H. Steinbach.*** *Deutsche Keramischen Gesellschaft, Berichte*, v. 36, no. 6, June 1959, p. 169-173.

**11240 Araldite, a Plastic for Working Models in the Ceramic Industry.** Araldite binding agents are ethoxyline resins which can be used for gluing materials such as lightweight metals, iron, ceramics, and glass. (*In German.*) Araldit, ein Kunstharz für Arbeitsmodelle in der keramischen Industrie. ***K. Leutner.*** *Deutsche Keramischen Gesellschaft, Berichte*, v. 36, no. 6, June 1959, p. 174-175.

**11241 Effects of Hydration Procedures and Calcination in the Presence of NaCl on the Properties of Lime Hydrates.** A study of factors that affect the properties of lime putties. ***D. L. Deadmore and J. S. Machin.*** *Illinois State Geological Survey, Circular* 270, 1959, 33 pp. (TN21 IL6.7c Vis.)

**11242 Graphite—How it Compares With Metals, Ceramics.** Comparison of strength, strength-to-weight ratio, thermal expansion, thermal conductivity, and electrical resistivity. ***G. B. Engle and L. M. Liggett.*** *Materials in Design Engineering*, v. 49, June 1959, p. 88-90.

**11243 Strength of Ceramics at High Temperatures.** Strength of $Al_2O_3$ single crystals (sapphire and ruby) was studied at temperatures between 600 and 1,000 C. The study supports the theory that, in properly oriented crystals, plastic deformation relieves stress concentrations, thus increasing crystal strength. *National Bureau of Standards, Technical News Bulletin*, v. 43, July 1959, p. 128-129.

**11244* The Coming Role of Pozzolans. Development of Modern Buffered Concrete and New Manufacturing Opportunities.** ***Wolf G. Bauer.*** *Pit and Quarry*, v. 51, no. 12, June 1959, 92 + 6 pages.

**11245* Let's Look at Kiln Efficiency.** With improved cement kiln design and regenerative clinker cooling, kiln capacity can be doubled or tripled. ***Victor J. Azbe.*** *Rock Products*, v. 62, June 1959, p. 81 + 7 pages.

**11246 Stabilization of $UO_2$ by Valence Compensation.** The oxidation and vaporization characteristics of $UO_2$ were compared directly to solid solutions of $UO_2$ containing from 30 to 60 w/o of $La_2O_3$. These solid solutions, which have the fluorite structure, were formed by reacting $UO_2$ and $La_2O_3$ in vacuo. When these materials were oxidized the fluorite structure was retained with, however, reduced lattice parameters. These were shown to be equivalent to reacting $U_3O_8$ with $La_2O_3$. ***Wendell B. Wilson.*** *U. S. Atomic Energy Commission, BMI*-1318, Feb. 4, 1959, 26 pp. (UF767 U3b Contin.)

**11247 Properties of Uranium Monocarbide.** ***C. A. Smith and Frank Rough.*** *U. S. Atomic Energy Commission, NAA-SR*-3625, June 1, 1959, 17 pp. (UF767 Un3.1na Contin.)

*See also:* **11472** (coating graphite with SiC); **11917** (ceramic cutting tools); **12215** (magnetism of oxide structures).

## CHEMICAL ENGINEERING

**11248* The Development of the Synthetic Aromatics Industry Over the Last Fifty Years.** The use of new reactions, the improvement of technical processes, the discovery of new structural types have revealed thousands of odorous substances. They can become synthetic aromatics only by combining economically and technically favorable conditions for their use in perfumery. ***Yves-Rene Naves.*** *American Perfumer and Aromatics*, v. 74, July 1959, p. 27-29.

**11249 American Petroleum Refining.** Shows why, how, and when modern processes and equipment were developed; includes information on the chemical and physical properties of hydrocarbons, the characteristics of crude oils and products, and the relationship of auxiliary services such as power, water,

waste disposal, and fire protection. ***H. S. Bell.*** 4th Ed. 533 pp. 1959. D. Von Nostrand Co., Princeton, N. J. (TP690 B41a4)

**11250* Influence of Water Composition on the Corrosion of Steel.** ***George B. Hatch and Owen Rice.*** *American Water Works Association, Journal,* v. 51, June 1959, p. 719-727.

**11251* Economic Boundaries of Saline Water Conversion.** ***Louis Koenig.*** *American Water Works Association, Journal,* v. 51, July 1959, p. 845-862.

**11252* Effectiveness of Halogens or Halogen Compounds in Detoxifying *Clostridium botulinum* Toxins.** ***A. Richard Brazis, et al.*** *American Water Works Association, Journal,* v. 51, July 1959, p. 902-912.

**11253 An Annual Review of World Production and Consumption of Fertilizers.** Records and analyzes world production and consumption of fertilizers. ***H. J. Page.*** 103 pp. 1958. Food and Agriculture Organization of the United Nations, Rome. (S631 F73a Vis.)

**11254* Moisture Measurement and Automatic Control.** Only electrical conductivity and capacitance techniques are used for continuous measurement and control. Discusses bound and free moisture, drying by heating, drawbacks of heating, carbide dessicants, titration, conductivity, capacitance, continuous measurement, two position control, three-term control. ***S. J. Broadbent.*** *Automation Progress,* v. 4, June 1959, p. 192-195.

**11255* Carbon.** Physical and technical properties, other qualities, modern application of C are discussed. Mentions raw materials for making C and graphite and the use for C in continuous casting processes. ***L. Sanderson.*** *Canadian Mining Journal,* v. 80, July 1959, p. 78-81.

**11256* Fractional Distillation.** Discusses mathematical design of columns, graphical methods for binary separation, calculation by computers, reflux and thermodynamic efficiency, heat transfer vs. mass transfer rate functions, contacting devices, control techniques, and some specific separating problems. ***H. H. M. Jones.*** *Chemical & Process Engineering,* v. 40, June 1959, p. 207-210.

**11257 Chemical Process Economics.** Economic balance; special mathematical techniques; over-all considerations in project analysis; and process plant components. ***John Happel.*** 291 pp. 1958. John Wiley & Sons, Inc., New York. (HD9650 H21c)

**11258 Problems in the Production of Pure Naphthalene by Distillation.** By fine fractionation of crude naphthalenes with varying contents of tar bases and acids, the influence of washing on the recovery of pure naphthalene by distillation was investigated. ***C. Gewers.*** *Coal Tar Research Association, Report No.* 0235, June 15, 1959, 21 pp. (Translated from *Erdol und Kohle,* v. 12, Apr. 1959, p. 231-236.) (TP953 C63 Contin.)

**11259 Selecting Water-Soluble Gums.** Factors to be considered are discussed. ***Charles M. Ferri.*** *Drug and Cosmetic Industry,* v. 85, no. 1, July 1959, p. 44 + 3 pages.

**11260* Organic Heating Systems for Modern Process Industries.** ***A. R. Conant and M. F. O'Brien.*** *Heat Engineering,* v. 34, no. 3, May-June 1959, p. 34-37.

**11261* Selective Adsorbents Upgrade Gasoline by Removing Normal Paraffins.** Methods of operation and problems in using molecular sieves. ***G. R. Brown, Jr., R. A. Rightmire, and H. A. Strecker.*** *Oil and Gas Journal,* v. 57, no. 24, June 8, 1959, p. 189-192.

**11262* Atlantic Develops New Process for Sulfur Recovery From Refinery Gases.** A multivalent ion such as Fe with a chelating agent is employed. Sulfur is formed as finely divided solid. ***R. W. Rieve, P. M. Pitts, Jr., and L. N. Leum.*** *Oil and Gas Journal,* v. 57, no. 24, June 8, 1959, p. 180 + 2 pages.

**11263* The Economics of Two-Stage Cat Cracking.** Plant has been in operation at the Anacortes Refinery of Shell Oil Co. for about 3 years. Briefly describes the unit, commercial experience with several types of feed stocks, results of engineering studies of certain features of the unit, and summary of a detailed economic analysis of the process. ***C. A. Rehbein, W. A. Mitchell, R. A. Wilson, and W. V. Medlin.*** *Oil and Gas Journal,* v. 57, no. 25, June 15, 1959, p. 108 + 9 pages.

**11264* The Alkazid Process for Removing $H_2S$ and $CO_2$ From Natural or Plant Gas.** Concentrated aqueous solutions of amino acids are used to remove $H_2S$ or $CO_2$ selectively or simultaneously. ***Rolf Leuhddemann, Guenther Noddes, and Hans-Georg Schwarz.*** *Oil and Gas Journal,* v. 57, no. 32, Aug. 3, 1959, p. 100 + 2 pp.

**11265* Advantages of Electric Drying.** Extremely fast heat transfer makes infrared drying effective in various converting operations. ***Donald J. Doyle.*** *Paper, Film and Foil Converter,* v. 33, Aug. 1959, p. 36 + 1 page.

**11266* Investigations and Experiences on Drying Sawdust With Flue-gas.** Experiments conducted in a suspension drier, a flue-gas drum drier, and a steam drum drier revealed that suspension drying is the most suitable method for drying sawdust. (*In Norwegian.*) Undersøkelser og erfaringer vedrørende sagspontørkning med røkgass. ***Karl Mørkved.*** *Paperi ja Puu,* v. 41, no. 6, June 1959, p. 309 + 6 pages.

**11267 Processing Crude Oil at Low pH.** Reduction of $NH_3$ contamination offers improved reformer charge stock quality, lowered costs of chemical treating of distillates, and minimized diesel fuel corrosive agents. ***J. A. Biehl and E. A. Schnake.*** *Petroleum Engineer,* v. 31, June 1959, p. C29 + 4 pages.

**11268 Distillation in View of Modern Developments.** Covers ternary equilibria, complex mixtures, and multicomponent systems. ***Kenneth F. Gordon and James A. Davies.*** *Petroleum Engineer,* v. 31, June 1959, p. C46 + 6 pages.

**11269 Get More Isomers at Low Temperature.** Esso's new isomerization process operates at low temperatures to take advantage of better equilibrium conditions. ***K. P. Lanneau, et al.*** *Petroleum Refiner,* v. 38, June 1959, p. 199-203.

**11270* Flow Meters Solve Touchy Problem at Chicago's Union Station.** A compressed air metering system set up in 1929 and still in use is described. ***J. Edwin Koch.*** *Plant,* v. 20, July 1959, p. 42-43.

**11271* Let's Learn More About Centrifugal Pumps.** Three case histories are considered. ***Igor J. Karassik.*** *Plant,* v. 20, July 1959, p. 44-46.

**11272* Disposal of Alkaline Wastes in the Petrochemical Industry.** ***Alex D. McRae.*** *Sewage and Industrial Wastes,* v. 31, June 1959, p. 712-718.

**11273* Source Book of Industrial Solvents. v. III. Monohydric Alcohols.** Presents the physical properties, azeotropic mixtures, and uses of industrial alcohols. Surveys early production by malting and brewing and leads up to present day synthesis—Fischer-Tropsch, Isosynthesis, Oxo Process, and the Oxyl Process. Methods of manufacture and newer methods of fermentation are also discussed. ***Ibert Mellan.*** 276 pp. 1959. Reinhold Publishing Corporation, New York. (TP247.5 M48h Ref.)

**11274 Cost Estimates of Liquid Scrubbing Processes for Removing Sulfur Dioxide From Flue Gases.** Capital and operating costs have been estimated for removing $SO_2$ from flue gases of a 120,000-kw powerplant. The $SO_2$ content of the gases to be treated is 0.083 and 0.30%, respectively. Estimates have been made for 90% $SO_2$ removal from both gases. ***J. H. Field, L. W. Brunn, W. P. Haynes, and H. E. Benson.*** *U. S. Bureau of Mines Report of Investigations* 5469, 1959, 58 pp. (TN21 Un3r Vis.)

**11275 Molecular Distillation.** Reviews six types of vacuum stills. ***P. Ridgway Watt.*** *Vacuum,* v. 6, Apr. 1959, p. 113-160.

**11276* Coagulation. I. Introduction and Theory.** Chemical treatment for water clarification requires an understanding of color and turbidity; floc formation; chemical factors. ***Marvin Lane.*** *Water & Sewage Works,* v. 106, July 1959, p. 280-281.

**11277* Contemporary Views on Sugar Crystallization.** Structure of sucrose crystals, the causes of the solubility in water and some properties of saturated solutions are discussed, considering sucrose activity. Deals also with the theory of crystal nuclei formation and crystal growth in pure solutions and solutions containing nonsugars. (*In Polish.*) Współczesne poglądy na krystalizację cukru. ***Stanisław Zagrodzki.*** *Wiadomości Chemiczne,* v. 13, Apr. 1959, p. 185-208.

**11278 How to Control Paraffin in Separation Equipment.** Proper application of field tested techniques to pressure vessel and installation design will prevent undesirable wax accumulations. ***W. L. Scheirman.*** *World Oil,* v. 149, Aug. 1959, p. 89-91.

**11279* World's Largest Submarine Gas Line Boosts Lake Maracaibo Conservation.** A 40-in. submarine gas line has been laid by Creole to connect its major injection plants. ***R. B. Leathers.*** *World Petroleum,* v. 30, July 1959, p. 44-46.

**11280* Petrochemical Raw Materials for Nylon Resins. I.** The economic and supply situation pertaining to these petrochemical nylon intermediates is followed by the technology of their manufacture from petroleum sources. ***Peter W. Sherwood.*** *World Petroleum,* v. 30, July 1959, p. 59-61.

*See also:* **11600** (chemical market research); **11810** (constructional metals for fluorides); **12138** (rare earth refinement); **12141** (solid-liquid separations).

## CHEMISTRY—ANALYTICAL

**11281* Indirect Determination of Sulfate in Water by Means of Potassium Stearate Titration, Using Black Eriochrome T as an Indicator.** (*In Rumanian.*) Determinarea indirecta a sulfatilor din apa prin titrare cu stearat de potasiu folosind ca indicator eriocrom negru T. ***D. Ceauşescu.*** *Academia Republicii Populare Romine. Baza de Cercetări Stinţifice Timişoara. Studii Şi Cercetări Ştiinţifice. Seria Ştiinţe Chimice,* v. 5, nos. 1-2, Jan.-June 1958, p. 77-81.

**11282 Determination of the Tungsten Content in Alloyed Steels by the β, γ-Reflection Method.** ***J. Fodor.*** *Acta Chimica Academiae Scientiarum Hungaricae,* v. 19, no. 4, 1959, p. 327-335.

**11283 Contributions to the Analysis of Aldehydes. II. Iodimetric Method for the Direct Determination of Glyoxal Through Its Bisulfite Compound.** (*In German.*) Beiträge zur Analytik der Aldehyde. II. Jodometrisches Verfahren zur unmittelbaren Bestimmung von Glyoxal über seine Bisulfitverbindung. ***E. Schulek and L. Maros.*** *Acta Chimica Academiae Scientiarum Hungaricae,* v. 19, no. 4, 1959, p. 473-478.

**11284* Analysis of Plant Waxes by Means of Chromatography and X-Ray Diffraction.** Column chromatography of plant waxes by means of $Al_2O_3$ led to the isolation of fractions containing paraffins, esters, alcohols, or acids, as main constituents. These substances could be identified by means of X-ray analysis. ***N. Wiedenhof.*** *American Oil Chemists' Society, Journal,* v. 36, July 1959, p. 297-300.

**11285* Gas-Liquid Chromatography of Fatty Derivatives. II. Analysis of Fatty Alcohol Mixtures by Gas-Liquid Chromatography.** ***W. E. Link, H. M. Hickman, and R. A. Morrissette.*** *American Oil Chemists' Society, Journal,* v. 36, July 1959, p. 300-303.

**11286* X-Ray Fluorescence Analysis—A Review.** ***F. Brown.*** *Analyst,* v. 84, June 1959, p. 344-355 + 2 plates.

**11287* The Quantitative Determination of Some Noble Metals by Atomic-Absorption Spectroscopy.** Silver, Au, Pt, Rh, and Pd have been quantitatively determined in concentrations down to 1 p.p.m. in solution. ***R. Lockyer and G. E. Hames.*** *Analyst,* v. 84, June 1959, p. 385-387 + 2 plates.

**11288* Separations Involving Sulphides. III. Separation of Molybdenum and Tellurium From Barium. IV. Separation of Arsenic, Antimony, Tellurium, and Mercury From Zirconium.** ***M. N. Srivastava.*** *Analytica Chimica Acta,* v. 20, no. 6, June 1959, p. 514-519.

**11289* The Determination of Molecular Weight Using Thermistors.** Method of less than 2% relative error, requiring less than 5 mg of sample and utilizing thermistors is described for the rapid determination of molecular weight. ***J. J. Neumayer.*** *Analytica Chimica Acta,* v. 20, no. 6, June 1959, p. 519-523.

**11290* A Systematic Scheme of Qualitative Analysis for Anions. III.** Two new reagents have been introduced for the separation of anions into groups, namely, zinc nitrate or acetate and cadmium nitrate. ***I. K. Taimni and Manohar Lal.*** *Analytica Chimica Acta,* v. 21, no. 1, July 1959, p. 1-3.

**11291* Voltammetric, Potentiometric and Amperometric Studies With a Rotated Aluminum Wire Electrode. I. Voltammetric Behavior of the R.Al.E.** ***I. M. Kolthoff and C. J. Sambucetti.*** *Analytica Chimica Acta,* v. 21, no. 1, July 1959, p. 17-24.

**11292* High Frequency Titration and Estimation of Ions. II. Determination of Barium, Lead, Thallium, Calcium, Cerium, Copper and Silver.** ***A. K. Majumdar and B. K. Mitra.*** *Analytica Chimica Acta,* v. 21, no. 1, July 1959, p. 29-32.

**11293* Tartrazine, a New Selective Reagent for Zirconium.** New method for determining Zr in which tartrazine serves as reagent. Reagent appears to be very selective, and can be used for the determination of Zr in alloys and ores. ***Gh. Baiulescu and L. Turcu.*** *Analytica Chimica Acta,* v. 21, no. 1, July 1959, p. 33-35.

**11294* Determination of Copper and Zinc in Metallurgical Products by Automatic Derivative Spectrophotometric Titrations.** Direct automatic derivative spectrophotometric titration procedures for Cu and Zn in brasses and bronzes. ***H. V. Malmstadt and T. P. Hadjiioannou.*** *Analytica Chimica Acta,* v. 21, no. 1, July 1959, p. 41-46.

**11295* The Determination of Small Amounts of Tin in Copper and Its Alloys.** Turbidimetric procedures are recommended for the determination of tin, over the range 0.001-0.4%, in Cu-base materials. Procedures are simpler and invariably quicker. ***H. J. G. Challis and J. T. Jones.*** *Analytica Chimica Acta,* v. 21, no. 1, July 1959, p. 58-67.

**11296 New Method of Hydrocarbon Structural Group Analysis.** Three chemical, and two physical properties are expressed in terms of five structural groups, in a form which may be simultaneously solved by modern high-speed computing equipment. ***D. S. Montgomery and M. L. Boyd.*** *Analytical Chemistry,* v. 31, Aug. 1959, p. 1290-1298.

**11297 Identification and Analysis of Polyurethane Rubbers by Infrared Spectroscopy.** A hydrolytic method of degradation of polyurethanes into portions which can be identified by their infrared spectra is outlined. ***P. J. Corish.*** *Analytical Chemistry,* v. 31, Aug. 1959, p. 1298-1306.

**11298 Infrared Determination of Nitrocellulose in Mixtures of Cellulose Resins.** Results obtained on synthetic mixtures of known composition indicate a maximum deviation of ± 1%, and a mean deviation of ± 0.4%, as determined from four separate samplings of each mixture. ***Helen M. Rosenberger and Clarence J. Shoemaker.*** *Analytical Chemistry,* v. 31, Aug. 1959, p. 1315-1317.

**11299 Estimation of Arsenic in Biological Tissue by Activation Analysis.** Quick and accurate method for the estimation of As in very small samples of biological materials. ***Hamilton Smith.*** *Analytical Chemistry,* v. 31, Aug. 1959, p. 1361-1363.

**11300 Determination of Silver in Photographic Papers and Films by Wet Ashing.** Rapid method for the determination of Ag in Ag-bearing materials (photographic films, papers, emulsions, etc.) makes use of wet oxidation of organic matter and halides by boiling in a sulfuric-nitric acid mixture and titrating the resulting $Ag_2SO_4$ solution. ***Eugene E. Gansel.*** *Analytical Chemistry,* v. 31, Aug. 1959, p. 1366-1368.

**11301 Determination of Vitamin D in Multivitamin Mixtures After Separation by Partition Chromatography.** Partition chromotography offers a rapid, reproducible method that, for analytical purposes, is superior to adsorption chromatography. ***James G. Theivagt and Donald J. Campbell.*** *Analytical Chemistry*, v. 31, Aug. 1959, p. 1375-1377.

**11302 Preparative Aspects of Gas-Liquid Chromatographic Separation. Quantitative Determination of Tetraalkyltetrazenes.** ***Everett M. Bens and William R. McBride.*** *Analytical Chemistry*, v. 31, Aug. 1959, p. 1379-1383.

**11303 Rapid Determination of Phosphorus in Motor Oils and Additives.** Phosphorus is determined by a combination of modified Schöniger oxidation scheme and colorimetry. ***J. E. Barney II, J. G. Bergmann, and W. G. Tuskan.*** *Analytical Chemistry*, v. 31, Aug. 1959, p. 1394-1396.

**11304 Carminic Acid Procedure for Determination of Boron.** Procedure proposed has shown accuracy and precision to $\pm$ 0.3 $\gamma$ of B over the range of 0 to 40 $\gamma$ of B. ***Durward L. Callicoat and John D. Wolszon.*** *Analytical Chemistry*, v. 31, Aug. 1959, p. 1434-1437.

**11305* Gas Chromatography Applied to the Analysis of Phenols.** Phenolic mixtures may be partially separated by gas chromatography either on polar or non-polar stationary phases, different groupings of the phenols being obtained on the two types. ***J. S. Fitzgerald.*** *Australian Journal of Applied Science*, v. 10, no. 2, June 1959, p. 169-189.

**11306 Polyester Liquid Phases in Gas-Liquid Chromatography.** ***E. C. Horning, E. A. Moscatelli, and C. C. Sweeley.*** *Chemistry & Industry*, 1959, no. 25, June 20, p. 751-752.

**11307* Inorganic Nitrogen Compounds. III. Separation of Inorganic Nitrogen Compounds by Means of Iontophoresis on Paper.** A study of the separation of ammonia, hydroxylamine, hydrazine, hyponitrite, nitrohydroxylaminate, nitrite, and nitrate by means of paper iontophoresis; an identification method was developed. (*In German.*) Anorganische Stickstoffverbindungen. III. Trennung anorganischer Stickstoffverbindungen mittels Papieriontophorese. ***J. Vepřek-Šiška, F. Šmirous, V. Plíška, and F. Veselý.*** *Collection of Czechoslovak Chemical Communications*, v. 24, no. 5, May 1959, p. 1385-1388.

**11308* Gas Chromatography of Monovalent Phenols.** The relationship between the structure of the molecule of the stationary phase and the selective distribution of the phenols was explained. The specific elution volumes (chromatographic spectra) of 19 phenols were measured on nonpolar and polar phases. Apiezon L or dimethylpolysiloxane are suitable for the separation according to the C atom number. (*In German.*) Gaschromatographie einwertiger Phenole. ***J. Janák, R. Komers, and J. Síma.*** *Collection of Czechoslovak Chemical Communications*, v. 24, no. 5, May 1959, p. 1492-1508.

**11309* Direct and Simultaneous Quantitative Determination of Strontium, Calcium, Sodium, Potassium, and Lithium in the Presence of Aluminum, Iron, Titanium, and Magnesium by Means of Flame Spectrophotometry.** The ray emissions of these five elements, especially of Ca and Sr, are disturbed by the ions present in the solution and in particular by Al. These effects are eliminated by the additions of high oxine concentrations, so that the five elements can be analyzed simultaneously in materials as complex as silicates. (*In French.*) Dosages directs et simultanés de strontium, calcium, sodium, potassium et lithium en présence d'aluminium, fer, titane et magnésium par spectrophotométrie de flamme. ***Jeannine Debras-Guédon and Igor Voinovitch.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 248, no. 24, June 15, 1959, p. 3421-3423.

**11310* Analytical Detection of Synthetic Antioxidants in the Edible Oils. II. Separation and Identification of Synthetic Antioxidants Through Thin-Film Chromatography.** Difficulties in the detection of synthetic antioxidants have been overcome by use of thin-film chromatography. The use of phosphomolybdic acid for coloring the analyzed substances makes the method very sensitive. The method has universal application and is not affected by the presence of other natural products in oils. (*In German.*) Der analytische Nachweis synthetischer Antioxydantien in Speisefetten. II. Trennung und Identifizierung synthetischer Antioxydantien durch Dunnschicht-Chromatographie. ***A. Seher.*** *Fette, Seifen, Anstrichmittel*, v. 61, no. 5, May 1959, p. 345-351.

**11311* Flame Photometric Determination of Calcium, Magnesium, and Potassium in Canned Tomatoes.** Flame photometric method was used to determine Ca, Mg, and K in canned whole tomatoes. In addition, the versene extraction method of determining Ca is compared with the ashing method. ***B. S. Luh and G. Niketic.*** *Food Research*, v. 24, no. 3, May-June 1959, p. 305-309.

**11312 Utilization of Gas Phase Chromatography for Identification of Volatile Products From Alkaline Degradation of Herqueinone.** Low molecular weight carbonyl compounds may be conveniently identified by gas chromatography of their oximes. ***James Cason and Edwin R. Harris.*** *Journal of Organic Chemistry*, v. 24, May 1959, p. 676-679.

**11313 Use of Tetracyanoethylene as a Color-Forming Reagent in Paper Chromatography of Aromatic Compounds.** ***D. S. Tarbell and Therese Huang.*** *Journal of Organic Chemistry*, v. 24, June 1959, p. 887-888.

**11314* Separation & Identification of Hydroxy Acids in Shellac. I. Chromatographic Separation & Identification.** $R_f$ values of the known constituent acids of shellac, viz., butolic acid, aleuritic acid, isomer of aleuritic acid, and shellolic acid, were determined in a number of solvent systems by ascending and descending paper chromatography. ***S. C. Sen Gupta.*** *Journal of Scientific & Industrial Research*, v. 18B, May 1959, p. 210-212.

**11315* Quantitative Determination of Mercurichlorides of Some Furan Compounds.** A new method differs from other methods in that the removing of Hg is carried out by treating with $H_2S$ at elevated or room temperature in alkaline alcohol or acetone solutions. (*In Russian.*) Metod kolichestvennogo opredeleniia rtuti v merkurikhloridakh furanovogo riada. ***S. Giller, A. Krauia, and Z. Ia. Zelmene.*** *Latvijas PSR Zinātnu Akademijas Vestis*, 1959, no. 4, p. 75-79.

**11316* A New Rapid Method for the Determination of Thorium in the Presence of Zirconium, Iron, Lanthanum, Uranium and Other Heavy Metals.** A selective and easy method for the determination of Th was used in the presence of rather large amounts of Zr, Fe, La, U, Mn, Mg, and of smaller amounts of Co and Ni. The method is based on the fact that Th complexon under pH=1 can be split up by $Na_2SO_4$ and the $Bi(NO_3)_3$ solution can be titrated with xylene orange. (*In Hungarian.*) Új gyors módszer a tórium meghatározására cirkon, vas, lantán, urán és egyéb nehézfémek jelenlétében. ***Rudolf Přibil and Kalman Burger.*** *Magyar Kémiai Folyóirat*, v. 65, no. 5, May 1959, p. 204-206.

**11317* A Turbidimetric Micromethod for Analysis of Tertiary Butyl Alcohol.** Rapid turbidimetric method for the analysis of very dilute aqueous solutions of tertiary butyl alcohol using a $HgSO_4/H_2SO_4$ reagent similar to the Denigès reagent. Concentrations as low as 1-6 mg/l. can be determined to within about 5% error. ***M. R. F. Ashworth.*** *Mikrochimica Acta*, 1959, no. 4, p. 506-512.

**11318* The Spectrophotometric Determination of Germanium With Phenylfluorone.** ***J. D. Burton and J. P. Riley.*** *Mikrochimica Acta*, 1959, no. 4, p. 586-591.

**11319* Mechanism and Elimination of Interferences in Flame Photometry.** Experimental methods of investigation and suppressing effects of Al, borate, phosphate, and sulfate on Ca radiation. ***Shouzow Fukushima.*** *Mikrochimica Acta*, 1959, no. 4, p. 596-618.

**11320* The Analysis of Fatty Acid Esters by Gas Chromatography.** ***Nathaniel Brenner, Phillip Scholly, and Lawrence O'Brien.*** *NLGI Spokesman*, v. 23, no. 4, July 1959, p. 137-142.

**11321 Plasma Jet as a Spectroscopic Source.** Temperatures up to 8000 C obtained with the plasma jet for spectral excitation of elements vaporized from a solution. Standard solutions are used to compare relative emission intensities in making

quantitative determinations. Modified plasma jet offers promise as a means of excitation for the spectrographic analysis of complex alloys. *National Bureau of Standards, Technical News Bulletin*, v. 43, July 1959, p. 126-127.

**11322 Nylon Capillary Columns for Use in Gas-Liquid Chromatography. *R. P. W. Scott.*** *Nature*, v. 183, June 20, 1959, p. 1753-1754.

**11323* Low Temperature Phase Separation of Alkyds.** Study of oil modified alkyd resins by segregation from a suitable solvent at progressively lower temperatures. ***A. J. Seavell.*** *Oil & Colour Chemists' Association, Journal*, v. 42, May 1959, p. 319-356.

**11324 Progress in Nuclear Energy. Series IX. Analytical Chemistry. v. I.** Reactor applications, activation analysis, spectrographic techniques, industrial applications, health physics. ***M. T. Kelley, editor.*** v. I. 365 pp. 1959. Pergamon Press, New York. (QC776 P94n)

**11325 Detection of Nitrite Ion in Plutonium Nitrate Solutions.** Colorimetric and potentiometric methods were developed for the very rapid detection of nitrite ion in the 2AF Purex process stream. ***Myron O. Fulda.*** *U. S. Atomic Energy Commission, DP*-336, Dec. 1958, 7 pp. (UF767 Un3.1dp Contin.)

**11326 The Determination of Plutonium in Irradiated Uranium Fuel Solutions by Controlled Potential Coulometry.** Controlled potential coulometry has been applied to the determination of Pu solution concentrations in the range 0.05 to 50 g./l. Electronic equipment, titration cells, and procedures are described. ***R. M. Peekema and F. A. Scott.*** *U. S. Atomic Energy Commission, HW*-58491, Dec. 10, 1958, 29 pp. (UF767 Un3.1hw Contin.)

**11327 Internal Standard Method of General Spectrographic Analysis.** General spectrographic method of moderate accuracy has been developed for analysis of diverse materials. The method has been studied by the preparation of working curves for the elements Cr, Fe, Ni, Co, Al, Mo, Cu, B, Mg, Mn, Sn, Si, U, Bi, Be, Pb, Ti, Ag, Zn, and Zr. ***F. M. Smith.*** *U. S. Atomic Energy Commission, HW*-59864, Apr. 9, 1959, 16 pp. (UF767 Un3.1hw Contin.)

**11328* Colorimetric Titration of Vanadium With Alkaline Ferricyanide.** The gradual disappearance of the yellow color of ferricyanide with the addition of vanadyl ions in alkaline medium has been made the basis of the quantitative determination of both V and ferricyanide. The colorimetric titrations were carried out with the aid of a Hilger Spekker Absorptiometer with a blue filter having maximum transmission in the range of 450-500 mμ. Accuracy of the results compares favorably with those obtained by other standard procedures. ***S. V. Tatwawadi.*** *Zeitschrift für Analytische Chemie*, v. 168, no. 1, 1959, p. 15-17.

**11329* Determination of Copper in Steel, Ferroalloys, Aluminum, Chromium, Cobalt, Manganese and Nickel. Extraction Method With 2,2' -Diquinolyl.** Only Cu(1)-ions form the complex with diquinolyl. Reduction is obtained by means of $H_2SO_3$ with addition of $FeCl_2$ solution. The disturbing effect of the elements accompanying Cu is not noticeable. Suggested modification of the Elwell method can be used in determining from 0.001 to 2% Cu in alloyed and high-alloyed steels and others mentioned, with much more rapidity and accuracy than other known methods. (*In German.*) Die Bestimmung von Kupfer in Stahl, Ferrolegierungen, Aluminium, Chrom, Kobalt, Mangan und Nickel. Extraktionsverfahren mit 2,2'-Dichinolyl. ***A. J. Leeb and F. Hecht.*** *Zeitschrift für Analytische Chemie*, v. 168, no. 2, 1959, p. 101-106.

**11330* A New Volumetric Method for the Determination of Molybdenum(VI). Use of Hydrazine Sulphate as Reductant.** Method consists in the reduction of Mo(VI) by heating with a slight excess of hydrazine sulfate in HCl medium on a water bath. Mo(V) obtained is determined by titration with a standard solution of ceric sulfate. ***G. Gopala Rao and M. Suryanarayana.*** *Zeitschrift für Analytische Chemie*, v. 168, no. 3, 1959, p. 177-181.

**11331* Precipitation Paper Chromatography—A Method for Determining Relative Solubility of Sparingly Soluble Compounds.** Drop modification of precipitation paper chromatography for simple and rapid determination of relative solubility of sparingly soluble compounds. Sorption series of the relative solubility of silicates, arsenites, phosphates, chromates, and ferrocyanides of a large number of metals have been obtained. (*In Russian.*) Osadochnaia khromatografiia na bumage kak metod opredeleniia otnositel'noĭ rastvorimosti malorastvorimykh soedineniĭ ***F. N. Kulaev.*** *Zhurnal Analiticheskoĭ Khimii*, v. 14, no. 3, May-June 1959, p. 278-282.

**11332* New Photometric Method for the Determination of Nickel.** A 0.02% aqueous solution of a purple-red purpuric acid ammonium salt color reacts with a Ni ammonia complex developing an orange-yellow color. It is possible to detect 0.2 μg of Ni in 1 ml of a solution at the limiting dilution of 1 : 5,000,000. (*In Russian.*) Novyĭ fotometricheskiĭ metod opredeleniia nikelia. ***M. Ia. Shapiro.*** *Zhurnal Analiticheskoĭ Khimii*, v. 14, no. 3, May-June 1959, p. 365-366.

## CHEMISTRY—INORGANIC AND GENERAL

**11333* Addition Compounds of Antimony Chlorides With Sulfoxides and Sulfones.** Liquidus curves; melting point relations. ***Ingvar Lindqvist and Pall Einarsson.*** *Acta Chemica Scandinavica*, v. 13, no. 3, 1959, p. 420-424.

**11334 The Complexes of Calcium Ion With Pyrophosphate and Triphosphate Ions.** Stabilities of the complexes of Ca ion have been calculated from the pH lowering, due to complex formation during the titration of pyrophosphate ion and triphosphate ion with hydrogen ion. ***James I. Watters and Sheldon M. Lambert.*** *American Chemical Society, Journal*, v. 81, July 5, 1959, p. 3201-3203.

**11335* Some Studies in Inorganic Complexes. IV. Titanium(III) and Titanium(IV).** Titanium complexes $TiCl_3 \cdot D \cdot H_2O$, $TiBr_3 \cdot D \cdot H_2O$, $TiCl_4 \cdot D$, and $TiBr \cdot D$, in which D is *o*-phenylenebis-dimethylarsine, were prepared and studied. ***G. J. Sutton.*** *Australian Journal of Chemistry*, v. 12, no. 2, May 1959, p. 122-126.

**11336 Physics and Chemistry of the Inorganic Azides.** Preparation; physical properties; thermochemistry; the azide radical; thermal decomposition, photochemical decomposition, ignition of inorganic azides. ***B. L. Evans, A. D. Yoffe, and Peter Gray.*** *Chemical Reviews*, v. 59, no. 4, Aug. 1959, p. 515-568.

**11337 Preparation of Germane. I. Reaction Between Lithium Aluminium Hydride and Germanium Tetrachloride. II. Reaction Between Sodium Borohydride and Germanium Tetrachloride. *E. D. Macklen.*** *Chemical Society, Journal*, 1959, June, p. 1984-1992.

**11338 The Reaction Between Ammonia and Transition-Metal Halides. VI. The Reaction of Ammonia With Tungsten(VI) Chloride. *G. W. A. Fowles and B. P. Osborne.*** *Chemical Society, Journal*, 1959, June, p. 2275-2279.

**11339 Melting Point and Sublimation of Molybdenum Disulphide.** Experiments made in connection with the preparation of clean $MoS_2$ surfaces, which are relevant to the question of the melting point of the material. ***Peter Cannon.*** *Nature*, v. 183, June 6, 1959, p. 1612-1613.

**11340 Lowest Oxidation States of Technetium and Rhenium.** Polarographic reductions of potassium perrhenate and pertechnate in 2 *N* KCl were compared. ***R. Colton, J. Dalziel, W. P. Griffith, and G. Wilkinson.*** *Nature*, v. 183, June 20, 1959, p. 1755.

**11341* The Phosphonitrilic Compounds.** General review of some of the properties and reactions of the phosphonitrilic compounds and a discussion of some of the more recent advances in this field, based upon research currently in progress in the University of Illinois. ***L. F. Audrieth.*** *Record of Chemical Progress*, v. 20, no. 2, June 1959, p. 57-69.

**11342* Concerning Calcium Germanium Hydrides; Preparation and Properties.** A study covering the reactions between $CaH_2$ and $GeO_2$; preparation of $GaGe_2$, CaGe, and CaGe; their

properties, structure, and thermal stability; mechanism of the oxidation, comparison with the corresponding silicides. (*In French.*) Sur les germaniures de calcium; préparation et propriétés. ***William Freundlich and Michel Bichara.*** *Société Chimique de France, Bulletin,* 1959, no. 5, May, p. 709-712.

**11343 The Bismuth-Bismuth Trichloride System.** Phase equilibrium study. Experimental techniques included sampling at temperature, thermal analysis, and visual observations. ***S. J. Yosim, A. J. Darnell, W. G. Gehman, and S. W. Mayer.*** *U. S. Atomic Energy Commission, NAA-SR-3371,* May 1, 1959, 10 pp. (UF767 Un3.1na Contin.)

**11344* Studies on the Behaviour of Cuprous Chloride in Hydrochloric Acid and Potassium Chloride Solutions. I. Chemical Analysis in the Aqueous Phase.** ***Wahid U. Malik, S. M. Fazlur Rahman, and S. Anwar Ali.*** *Zeitschrift für Anorganische und Allgemeine Chemie,* v. 299, nos. 5-6, Apr. 1959, p. 322-327.

**11345* On Metal Complexes. The Crystalline Structure of Argentosulfonium Nitrate, $(Ag_3S)(NO_3)$.** Crystals of $(Ag_3S)(NO_3)$ can be prepared from $CS_2$ and a concentrated solution of $AgNO_3$. The structure consists of a three-dimensional endless cation $(Ag_3S)^+$ and nitrate ions. (*In German.*) Uber Metallokomplexe. Die Kristallstruktur des Argentosulfoniumnitrats, $(Ag_3S)(NO_3)$. ***Günter Bergerhoff.*** *Zeitshrift für Anorganische und Allgemeine Chemie,* v. 299, nos. 5-6, Apr. 1959, p. 328-337.

**11346* On the Isomerism of Hydroxyurea. XI. Absorption Spectra in the Infra-Red.** Brief survey of the Raman and infra-red spectroscopy of urea. ***Helmer Kofod.*** *Acta Chemica Scandinavica,* v. 13, no. 3, 1959, p. 461-472.

## CHEMISTRY—ORGANIC

**11347* A Method for the Preparation of *tert*-Alkylacetic Acids.** ***Arne Brändström.*** *Acta Chemica Scandinavica,* v. 13, no. 3, 1959, p. 608-610.

**11348* A Novel Reaction of Alkyl-Pyridines.** New reaction according to which alkyl pyridines afford with aryl sulfonyl chlorides under mild conditions, in fair yields, C-aryl sulfonyl derivatives without the use of catalysts. ***Z. Földi.*** *Acta Chimica Academiae Scientiarum Hungaricae,* v. 19, nos. 2-3, 1959, p. 205-216.

**11349* Organoboron Compounds. Reactions Between Boron Trialkyls and Compounds Containing Mobile Hydrogen.** A study of the reaction between tri-*n*-propyl, triisopropyl-, trisobutyl-, and triisoamylboron on the one hand and water, alcohols, phenol, amines, and mercaptans on the other. The higher borontrialkyls at 160-170 C react strongly with water with production of dialkyl boric acid, isolated during distillation in their anhydrides with 65-71% yields. (*In Russian.*) Bororganicheskie soedineniia. Reaktsii bortrialkilov s soedineniiami, soderzhashchimi podvizhnyĭ vodorod. ***B. M. Mikhailov, V. A. Vaver, and Iu. N. Bubnov.*** *Akademiia Nauk SSSR, Doklady,* v. 126, no. 3, May 21, 1959, p. 575-578.

**11350* Synthesis of Organosilicon Monomers From Dichlorosilane.** $Cl_2SiH_2$ was obtained by disproportionation of $Cl_3SiH$ in the presence of dimethyl cyanamides; phenyl silane chlorides were obtained by synthesis through the thermal condensation of $Cl_2SiH_2$ with benzene chloride. $Cl_2SiH_2$, and $n$-$FC_6H_4SiHCl_2$ were added to unsaturated compounds. The phenyl dichlorosilane $n$-fluoride $n$-$FC_6H_4SiHCl_2$ was synthesized. (*In Russian.*) Sintez kremneorganicheskikh monomerov iz dikhlorsilana. ***A. D. Petrov, V. A. Ponomarenko, and G. V. Odabashian.*** *Akademiia Nauk SSSR, Doklady,* v. 126, no. 5, June 11, 1959, p. 1009-1012.

**11351* Studies in the Field of Lacetones and Lactams. XIV. Synthesis of Vinylcaprolactams by Means of Indirect Vinylation. XV. Preparations of Polyvinylpyrrolidones Having Different Molecular Weights and Their Physico-Chemical Properties.** (*In Russian.*) Issledovanie v oblasti laktonov i laktamov. XIV. Sintez vinilkaprolaktama metodom kosvennogo vinilirovaniia. ***M. F. Shostakovskiĭ and F. P. Sidel'kovskaia.*** XV. Preparaty polivinilpirrolidona razlichnogo molekuliarnogo vesa i ikh fiziko-khimicheskie svoĭstva. ***M. F. Shostakovskiĭ, et al.*** *Akademiia Nauk SSSR, Izvestiia, Otdelenie Khimicheskikh Nauk,* 1959, no. 5, May, p. 892-900.

**11352 Aminoalkylamides and Oxazolidinediones.** A series of α-hydroxyamides and derived oxazolidindiones were examined for central nervous system depressant effects. Synthesis of the latter from the α-hydroxyester, the dialkylaminoalkylamine, and diethyl carbonate is described. ***Seymour L. Shapiro, Ira M. Rose, and Louis Freedman.*** *American Chemical Society, Journal,* v. 81, June 20, 1959, p. 3083-3088.

**11353 The Total Synthesis of Penicillin V.** Potassium phenoxymethylpenicillinate, synthesized totally in a series of reactions from D-penicillamine and *t*-butyl phthalimidomalonaldehydate, was shown to be identical to natural penicillin V (potassium salt) in physical and biological properties. ***John C. Sheehan and Kenneth R. Henery-Logan.*** *American Chemical Society, Journal,* v. 81, June 20, 1959, p. 3089-3094.

**11354 A Comparison of the Decomposition of Hexane and Cyclohexane by Different Types of Radiation.** Liquid products have been examined by gas chromatographic and infrared methods. ***Harold A. Dewhurst and Robert H. Schuler.*** *American Chemical Society, Journal,* v. 81, July 5, 1959, p. 3210-3212.

**11355 Reaction of Ferric Chloride With Alkanes.** ***Peter Kovacic and Herman C. Volz.*** *American Chemical Society, Journal,* v. 81, July 5, 1959, p. 3261-3264.

**11356 Synthesis of Some Epoxy Vinyl Monomers by Epoxidation With Peracetic Acid.** Studies of rates of epoxidation of several different types of double bonds with peracetic acid in various solvents were made to show the applicability of selective epoxidation. ***Frederick C. Frostick, Jr., Benjamin Phillips, and Paul S. Starcher.*** *American Chemical Society, Journal,* v. 81, July 5, 1959, p. 3350-3356.

**11357 The Reaction of Bis-(substituted-mercapto)-ethylenes With *n*-Butyllithium.** ***William E. Parham, Robert F. Motter, and Gwendolyn L. O. Mayo.*** *American Chemical Society, Journal,* v. 81, July 5, 1959, p. 3386-3391.

**11358 The Reaction of Olefins With Aromatic Substances in the Presence of Mercury Salts and Catalyst. III. Reaction of Various Olefins With Anisole.** ***Katsuhiko Ichikawa, Susumu Fukushima, Hajime Ouchi, and Minoru Tsuchida.*** *American Chemical Society, Journal,* v. 81, July 5, 1959, p. 3401-3404.

**11359 Photochemical Reactions in Sunlight. Experiments With Benzo(h)quinoline-5, 6-quinone, Monoimine and Monoxime Derivatives in Sunlight and in Dark.** ***Ahmed Mustafa, Abdel Kader Mansour, and Ahmed Fathy Abdel Mawgood Shalaby.*** *American Chemical Society, Journal,* v. 81, July 5, 1959, p. 3409-3413.

**11360* The Preparation of Tertiary Alcohols. I.** Outlines some of the more important chemical reactions by which tertiary alcohols can be prepared. ***Kurt Kulka.*** *American Perfumer and Aromatics,* v. 73, June 1959, p. 28 + 5 pages.

**11361* The Preparation of Tertiary Alcohols. II.** ***Kurt Kulka.*** *American Perfumer and Aromatics,* v. 74, July 1959, p. 21 + 6 pages.

**11362* Reactions of Aromatic Diazo-Compounds With Aliphatic Diazo-Compounds. II. The Azo-Coupling of the Quinone Diazines With Aliphatic Diazo-Compounds.** Substituted benzoquinone-(1,2)-diazine-(2) with sufficient electrophilic activity couples with aliphatic diazo-compounds. Diphenyldiazomethane and 9-diazo-fluorene yield substituted benzo-1,3,4-oxdiazine-(2H) with liberation of $N_2$; in one case only there is a *o*-quinone-azine as coupling product. According to the nature of the quinone diazine, benzo-1,3,4-oxdiazine-(4H) or -(2H) is derived from aryl-diazomethanes. (*In German.*) Reaktionen Aromatischer mit Aliphatischen Diazoverbindungen. II. Die Azokupplung der Chinondiazide mit aliphatischen Diazoverbindungen. ***Rolf Huisgen and Rudolf Fleischmann.*** *Annalen der Chemie (Justus Liebigs),* v. 623, nos. 1-3, 1959, p. 47-68.

**11363* Preparation of Acidylmesodiphenylanthracenes and Application to the Naphthacene Synthesis.** A study of the condensation of ethoxalyl chloride and of mesodiphenylanthracene in the presence of $AlCl_3$, yielding the ethyl ester of diphenyl-9, 10 anthryl-2 glyoxylic acid, and of the condensation of succinic anhydride and of mesodiphenylanthracene in the presence of $AlCl_3$ yielding diphenyl-9'10' anthroyl-2')-3 propionic acid. (*In French.*) Préparation d'acidylmésodiphénylanthracènes et emploi en synthèse naphtacénique. ***Roger-Gilbert Douris.*** *Annales de Chimie*, v. 4, May-June 1959, p. 470-539.

**11364 Aspects of the Organic Chemistry of Sulphur.** Simple organic compounds of S. Properties, preparation and biological significance. Natural sulfonium compounds, sulfides, sulfoxides, mercaptans, and sulfidoamino acids. Sulfur compounds of petroleum and other mineral oils. Natural mustard oil glucosides and the related *iso*thiocyanates and nitriles. Biological methylation. Co-enzyme A, its S-acetyl derivative, and related compounds. ***Frederick Challenger.*** 253 pp. 1959. Academic Press, New York. (QD341.S3 C35a)

**11365* The Synthesis of the Stereoisomeric Hexadeca-2,4-dienoic Acids and Their *iso*Butylamides.** ***P. C. Wailes.*** *Australian Journal of Chemistry*, v. 12, no. 2, May 1959, p. 173-189.

**11366* Studies in the Chemistry of Phenothiazine. IV. The Preparation of 2,2'-Dinitrodiphenylsulphides and Their Conversion to Phenothiazines.** ***K. J. Farrington.*** *Australian Journal of Chemistry*, v. 12, no. 2, May 1959, p. 196-198.

**11367* 2- and 3-Phenylthionaphthens.** Product obtained from 3-(1'-*cyclo*hexenyl)thionaphthen by dehydrogenation with S at 240-250 C is shown to be 2-phenylthionaphthen. ***S. Middleton.*** *Australian Journal of Chemistry*, v. 12, no. 2, May 1959, p. 218-223.

**11368 Boron Fluoride and Its Compounds as Catalysts in Organic Chemistry.** Monograph deals with the use of boron fluoride as a catalyst in organic chemistry and also with a number of its derivatives and corrodination compounds. ***A. V. Topchiev, S. V. Zavgorodnii, and Ya. M. Paushkin.*** (Translated from the Russian by J. T. Greaves.) 326 pp. 1959. Pergamon Press, New York. (QD181.B1 T62ftr)

**11369 The Furoxans.** Nomenclature, structure, isomers, reactions, and preparation. ***J. V. R. Kaufman and J. P. Picard.*** *Chemical Reviews*, v. 59, no. 3, June 1959, p. 429-461.

**11370 The Chemistry of the Glycocyamidines.** Synthesis; substitution reactions; physicochemical properties; color and other reactions of glycocyamidines for analytical purposes. ***Charles Lempert.*** *Chemical Reviews*, v. 59, no. 4, Aug. 1959, p. 667-736.

**11371 The Formation of Aromatic Hydrocarbons at High Temperatures. V. The Pyrolysis of 1-Phenylbuta-1:3-diene.** ***G. M. Badger and T. M. Spotswood.*** *Chemical Society, Journal*, 1959, May, p. 1635-1641.

**11372 The Cumulative Effect of Substituents on the Reaction of *NN*-Dimethylanilines With Allyl Bromide.** Formation of quaternary salts from allyl bromide and substituted dimethylanilines in aqueous acetone. ***H. P. Crocker and Brynmor Jones.*** *Chemical Society, Journal*, 1959, May, p. 1808-1816.

**11373 Two Isomeric Homologues of Thiamine.** Synthesis of two isomeric homologues of thiamine, and their behavior with alkali, potassium ferricyanide, and deuterium oxide and as catalysts for the conversion of pyruvate + acetaldehyde into acetoin + $CO_2$. ***J. Biggs and P. Sykes.*** *Chemical Society, Journal*, 1959, May, p. 1849-1855.

**11374 The Mechanism of Epoxide Reactions. I. The Reactions of 1:2-Epoxyethylbenzene, 1:2-Epoxy-3-phenylpropane, and 1:2-Epoxy-3-phenoxypropane With Some Secondary Amines.** ***N. B. Chapman, N. S. Isaacs, and R. E. Parker.*** *Chemical Society, Journal*, 1959, June, p. 1925-1934.

**11375 Aromatic Polyfluoro-Compounds. II. Pentafluorophenol.** Hexafluorobenzene reacts with sodium methoxide to give pentafluoroanisole which when heated with $AlCl_3$ yields pentafluorophenol. ***E. J. Forbes, R. D. Richardson, M. Stacey, and J. C. Tatlow.*** *Chemical Society, Journal*, 1959, June, p. 2019-2021.

**11376 Experiments Towards the Synthesis of Corrins. I. The Preparation and Reactions of Some $\Delta^1$-Pyrrolines. A Novel Proline Synthesis. II. The Preparation and Reactions of $\Delta^1$-Pyrroline 1-Oxides. III. Formation of a Bicyclic Oxaziran From a $\Delta^1$-Pyrroline and From the Corresponding Nitrone. IV. The Oxidation and Ring Expansion of 2:4:4-Trimethyl-$\Delta^1$-Pyrroline 1-Oxide. V. Base-Catalysed Aldol-Type Reactions of $\Delta^1$-Pyrroline 1-Oxides. VI. The Dimerisation of $\Delta^1$-Pyrroline 1-Oxides to 2-(1'-Hydroxypyrrolidin-2'-yl)-$\Delta^1$-pyrroline 1-Oxides. VII. The Reductive Dimerisation of a $\Delta^1$-Pyrroline 1-Oxide. Oxidative Degradation of 2:2'- and 2:3'-Bipyrrolidinyl Derivatives.** ***V. M. Clark, et al.*** *Chemical Society, Journal*, 1959, June, p. 2087-2127.

**11377 Acyl Isothiocyanates. III. Properties of Some Phosphoroisothiocyanatidates.** ***D. T. Elmore and J. R. Ogle.*** *Chemical Society, Journal*, 1959, June, p. 2286-2292.

**11378 A New Boronium Salt.** Diphenylboronium perchlorate in nitromethane solution reacts with α, α'-dipyridyl to give a high yield of α,α'-dipyridylodiphenylboronium perchlorate. This represents a new type of boron compound in which the boron atom in the monovalent cation attains its covalency maximum of four, through two B-C bonds and two dative covalent B-N bonds. ***J. M. Davidson and C. M. French.*** *Chemistry & Industry*, 1959, no. 25, June 20, p. 750.

**11379* The Chemistry of the Amino Naphthoquinones.** Starting from a survey of the chemistry of naphthazarin and its intermediate product, a report is made on some recent synthetic studies in this dye class which led to purple, blue, and green dispersion dyes. It is probable that the resonance structure of the naphthazarin intermediary product and of its derivatives is close to the formula 4,8-diamino-1,5-naphthoquinone. (*In German.*) Die Chemie der Aminonaphtochinone. ***Ernest Merian.*** *Chimia*, v. 13, no. 6, June 1959, p. 181-191.

**11380 Reactions of Sulphur With Araliphatic and Aliphatic Compounds.** Literature on reactions involving S and alkyl-substituted aromatic and heterocyclic compounds is reviewed, and full experimental data are given. ***R. Wegler, et al.*** *Coal Tar Research Association, Report No.* 0233, June 3, 1959, 30 pp. (TP953 C63 Contin.) (Translated from *Angewandte Chemie*, v. 70, no. 6, June 21, 1958, p. 351-367.)

**11381* Reduction of Some *N*-Substituted Aminoacetonitriles With Lithium Aluminium Hydride.** Reduction gave, besides the expected *N*-substituted ethylenediamines, also the corresponding substituted *N*-methylamines in varying yields. ***C. Benko and M. Tišler.*** *Croatica Chemica Acta*, v. 30, no. 4, 1958, p. 243-245.

**11382 Organic Derivatives of Silica Gel With the Si-O-C Bond. I. Organic Derivatives of Silica Gel With the Si-C Bond. II.** (*In German.*) Organische Derivate des Silikagels mit Si-O-C-Bindung. I. ***H. Deuel, J. Wartmann, K. Hutschneker, U. Schobinger, and C. Güdel.*** Organische Derivate des Silikagels mit Si-C-Bindung. II. ***J. Wartmann and H. Deuel.*** *Helvetica Chimica Acta*, v. 42, no. 4, 1959, p. 1160-1170.

**11383 Synthesis of Pyrimidines. A Study of the Condensation of Methyl Ethoxycarbonyl-dithioacetate With Amidines.** 2-Amino-4-hydroxy-6-mercaptopyrimidine was synthesized by condensation of guanidine with methyl ethoxycarbonyl-dithioacetate. Structure of the condensation product was proved by desulfurization to isocytosine and by comparison with a specimen prepared by treatment of 2-amino-4-chloro-6-hydroxypyrimidine with NaSH. (*In French.*) Synthèse de pyrimidines. Etude de la condensation de l'éthoxycarbonyl-dithioacétate de méthyle avec les amidines. ***D. Isbecque, R. Promel, R. C. Quinaux, and R. H. Martin.*** *Helvetica Chimica Acta*, v. 42, no. 4, 1959, p. 1317-1323.

**11384 New Local Anesthetics.** The mixed anhydride method has been used successfully in the synthesis of a series of pyridinecarboxamides. Hydrogenation of some of these products furnished piperidinecarboxamides which were found to possess

excellent local anesthetic properties and low toxicities. (*In German.*) Neue Lokalanästhetika. ***H. Rinderknecht.*** *Helvetica Chimica Acta,* v. 42, no. 4, 1959, p. 1324-1327.

**11385 Investigations Concerning the Formation and Transformation of Esters. XVII. Formation of Cyclic Phosphoric Esters and Speed of Hydrolysis of These Esters and of Dialkyl Phosphoric Esters.** The synthesis of cyclic phosphoric esters with 5, 6, and 7-membered rings by cyclization of hydroxy- or chloro-alkyl phosphoric acids or by direct phosphorylation of the corresponding diols or chloro-alcohols is described. The 6-membered cyclic esters are the easiest to obtain. (*In French.*) Recherches sur la formation et la transformation des esters. XVII. Sur la formation d'esters phosphoriques cycliques et sur la vitesse d'hydrolyse de ces esters et des esters dialcoylphosphoriques. ***Emile Cherbuliez, H. Probst, and J. Rabinowitz.*** *Helvetica Chimica Acta,* v. 42, no. 4, 1959, p. 1377-1384.

**11386* The Molecular Structure of Heavy Petroleum Compounds.** Molecules consist of one long carbon-atom chain, at one or possibly both ends of which a ring system or short branch may be attached. ***A. Hood, R. J. Clerc, and M. J. O'Neal.*** *Institute of Petroleum, Journal,* v. 45, June 1959, p. 168-173.

**11387 Low Temperature Amination of Aromatic Polyhalides.** Reaction of metal amides with aromatic polyhalides in liquid ammonia was used for the preparation of halogenated aromatic amines. Low-temperature amination reactions were demonstrated to serve as a method of separation and purification of mixtures of aromatic halides. ***John H. Wotiz and Francis Huba.*** *Journal of Organic Chemistry,* v. 4, May 1959, p. 595-598.

**11388 Sterically Hindered Reactions of Grignard Reagents With Schiff Bases.** ***Bertin L. Emling, et al.*** *Journal of Organic Chemistry,* v. 24, May 1959, p. 657-660.

**11389 Degradation of Corticosteroids. III. Catalytic Hydrogenation of Cortisol.** ***Eliahu Caspi.*** *Journal of Organic Chemistry,* v. 24, May 1959, p. 669-673.

**11390 Derivatives of Piperazine. XXXIV. Some Reactions of Trimethylene Chlorobromide With 1-Arylpiperazines.** ***C. B. Pollard, Werner M. Lauter, and Noel O. Nuessle.*** *Journal of Organic Chemistry,* v. 24, June 1959, p. 764-767.

**11391 The Structure of Certain Polyazaindenes. I. Absorption Spectra. II. The Product From Ethyl Acetoacetate and 3-Amino-1,2,4-triazole. III. 1,2,3a,7- and 1,3,3a,7-Tetrazaindenes. IV. Compounds From β-Keto Acetals and β-Methoxyvinyl Ketones.** ***C. F. H. Allen, et al.*** *Journal of Organic Chemistry,* v. 24, June 1959, p. 779-801.

**11392 Thermal Stability of Triphenylsilane, Di- and Tri(aralkyl)silanes, Dibenzylmethane, and Tribenzylmethane.** Thermal stabilities were tested by heating in partially evacuated sealed Pyrex tubes for 24 hr. at approximately 300 C. Tribenzylsilane was very stable under these conditions. ***Henry Gilman, Richard A. Tomasi, and Dietmar Wittenberg.*** *Journal of Organic Chemistry,* v. 24, June 1959, p. 821-824.

**11393 Sodium Acetylide. II. Reactions of Sodium Acetylide in Organic Diluents. Preparation of Monoalkyl Acetylenes.** Dimethyl sulfate reacted with sodium acetylide in organic diluents such as xylene to form 80-85% yields of propyne, along with 8-20% yields of 2-butyne. ***T. F. Rutledge.*** *Journal of Organic Chemistry,* v. 24, June 1959, p. 840-842.

**11394* Thiophenes & Thiapyrans. XX. Synthesis of Condensed Thiophenes From Diaryls.** Scope and limitations on the one-step synthesis of condensed thiophenes by the interaction of diaryls, S, and $AlCl_3$ are discussed. ***L. J. Pandya, G. N. Pillai, and B. D. Tilak.*** *Journal of Scientific & Industrial Research,* v. 18B, May 1959, p. 198-202.

**11395* Synthesis of Some $N^1$-$N^3$-Disubstituted Sulphonylureas.** ***M. H. Shah, M. Y. Mhasalkar, V. M. Patki, and C. V. Deliwala.*** *Journal of Scientific & Industrial Research,* v. 18B, May 1959, p. 202-204.

**11396 Organic Chemistry of Bivalent Sulfur.** Mercaptans, reactions of mercaptans, negative derivatives, substituted mercaptans, and mercapto-acids. ***E. Emmet Reid.*** v. I. 539 pp. 1958. Chemical Publishing Co., New York. (QD412.S1 R27o)

**11397* The Chemistry of the Thiocarbonyl Group.** Physical and chemical properties and preparation of thiocarbonyl compounds. ***Noël Lozac'h.*** *Record of Chemical Progress,* v. 20, no. 1, Mar. 1959, p. 23-32.

**11398* The Preparation of Some *p*-Nitrophenyl Dialkylphosphinates.** Physico-chemical constants of the yellow phosphinates are recorded; an example of the infrared spectra is given. ***A. M. de Roos and H. J. Toet.*** *Recueil des Travaux Chimiques des Pays-Bas,* v. 78, Apr. 1959, p. 271-274.

**11399* Reaction Products of Primary β-Hydroxy-Amines With Carbonyl Compounds. XIII. Condensation of Primary β-Mercaptoamines With Carbonyl Compounds. XIV. Reaction of 3-Aminopropanol With Carbonyl Compounds. XV. Condensation of Carbonyl Compounds With 3-Mercaptopropylamine. XVI. Condensation of Carbonyl Compounds With 4-Hydroxy- and 4-Mercaptobutylamine. XVII. Condensation of Carbonyl Compounds With Tetramethyleneglycol.** ***Ernst D. Bergmann and A. Kaluszyner.*** *Recueil des Travaux Chimiques des Pays-Bas,* v. 78, Apr. 1959, p. 289-342.

**11400* Review of Coal Tar Technology.** Production, preparation, properties, reactions, analysis, and utilization of coal tar and coal tar products. General chemistry and chemical technique. *Review of Coal Tar Technology,* v. 10, pt. 2, July-Dec. 1958, 166 pp.

**11401* Development of Methods for the Synthesis of Cellulose Esters With N-Substituted Amino Acids.** The following cellulose esters with N-substituted amino acids have been obtained by the action of the acyl chlorides of N-substituted amino acids on inclusion cellulose in a solvent medium: N-carbobenzoxy- and N-phthalyglycine, and N-carbobenzoxyaminoenanthic and N-phthalylaminoenanthic acids. The esters were of a degree of substitution from $\gamma = 20$ to 162. (*In Russian.*) Razrabotka metodov sinteza efirov tselliulozy s N-zameshchennymi aminokislot. ***Lin'-Ian', V. A. Derevitskaia, and Z. A. Rogovin.*** *Vysokomolekuliarnye Soedineniia,* v. 1, no. 1, Jan. 1959, p. 157-161.

**11402* Tautomerism of Some Heterocyclic Derivatives. VIII. The Infrared and Ultraviolet Spectra and the Structure of Oxyacridines and Dioxybiacridyls.** (*In Russian.*) O tautomerii nekotorykh proizvodnykh geterotsiklicheskikh soedinenīĭ. VIII. Infrakrasnye i ul'trafioletovye spektry i stroenie oksiakridinov i dioksibiakridilov. ***A. I. Gurevich and Iu. N. Sheĭnker.*** *Zhurnal Fizicheskoĭ Khimii,* v. 33, no. 4, Apr. 1959, p. 883-892.

**11403* Catalytic Oxidation of Propylene in Acrolein. I.** The tagged atom method revealed that when oxidizing propylene, the acetaldehyde is not a basic intermediate product of $CO_2$. Acrolein is oxidized on a Cu catalyst. The degree of oxidation depends on the concentration of the catalyst on the carrier. Eight catalysts found are listed. (*In Russian.*) Kataliticheskoe okislenie propilena v akrolein. I. ***O. V. Isaev, L. Iu. Margolis, and S. Z. Roginskiĭ.*** *Zhurnal Obshcheĭ Khimii,* v. 29, no. 5, May 1959, p. 1522-1527.

## CHEMISTRY—PHYSICAL

**11404* The Stability and Viscosity of Concentrated Suspensions in Oleogels of Metallic Soaps.** (*In Russian.*) Ob ustoĭchivosti i viazkosti kontsentrirovannykh suspenziĭ v oleogeliakh metallicheskikh myl. ***G. V. Belugina, S. Kh. Zakiev, P. A. Rebinder, and A. B. Taubman.*** *Akademiia Nauk SSSR, Doklady,* v. 126, no. 2, May 11, 1959, p. 318-321.

**11405* The Effect of Gamma Radiation From $Co^{60}$ on Hydrated Nitrate Crystals.** The initial nitrate yield does not depend on the importance of the radiation dose. When the integral radiation dose increases there is a well defined dependence of the yield of nitrate on the importance of the dose

characteristic for each salt. A minimum for $G_{SO_4^{2-}}$ with $0.8 \times 10^{15}$ ev/ml/sec. was found for the Ca and Cd nitrate groups. (*In Russian.*) Deĭstvie γ-izlucheniia $CO^{60}$ na kristallogidraty azotnokislykh soleĭ. ***A. S. Baberkin.*** *Akademiia Nauk SSSR, Doklady*, v. 126, no. 3, May 21, 1959, p. 591-593.

**11406* Studies of Properties of Metal-Oxide Catalysts of Gasoline Reforming. V. Some Peculiarities in Catalytic and Physical Properties of Palladium Catalysts.** (*In Russian.*) Issledovanie svoĭstv okisno-metallicheskikh katalizatorov reforminga benzinov. V. Nekotorye osobennosti kataliticheskikh i fizicheskikh svoĭstv palladievykh katalizatorov. ***Kh. M. Minachev, M. A. Riashentseva, and A. M. Rubinshteĭn.*** *Akadȩmiia Nauk SSSR, Izvestiia, Otdelenie Khimicheskikh Nauk*, 1959, no. 5, May, p. 819-825.

**11407 Transmission of Electronic Effects Through the —N=NC$_6$H$_4$—Group.** Acid dissociation constants in 20% ethanol of a series of *p*-arylazophenols are reported. ***Si-Jung Yeh and H. H. Jaffé.*** *American Chemical Society, Journal*, v. 81, July 5, 1959, p. 3287-3288.

**11408 Kinetics, Relative Rate and Partial Rate Factors for the Gallium Bromide-Catalyzed Reaction of Isopropyl Bromide Wtih Toluene and Benzene.** ***Sang Up Choi and Herbert C. Brown.*** *American Chemical Society, Journal*, v. 81, July 5, 1959, p. 3315-3320.

**11409 The Controlled Thermal Decomposition of Cellulose Nitrate. VI. Other Polymeric Nitrates.** Reduced pressure ignition products of amylose and amylopectin nitrates were found to correspond in identity and yield with those produced by cellulose nitrate. ***M. L. Wolfrom, Alan Chaney, and K. S. Ennor.*** *American Chemical Society, Journal*, v. 81, July 5, 1959, p. 3469-3473.

**11410* Physico-Chemical Investigations of Trihalogenated Chlorine-Bromine-Iodine Compounds.** These compounds were prepared in the solid state. The thermal analysis of the binary systems Br, I, and Br halide and of the metallic halide was carried out. Study was made of the reactions in non-aqueous solution of the monochloride and trichloride of I with HBr and several metallic bromides. (*In French.*) Recherches physico-chimiques sur les composés trihalogénés chlore-brome-iode. ***Maxime Graulier.*** *Annales de Chimie*, v. 4, May-June 1959, 427-478.

**11411 The Scission of the Sulfur-Sulfur Bond.** Analytical procedures for kinetic studies; homolytic scission; electrophilic scission; nucleophilic scission. ***Alan J. Parker and Norman Kharasch.*** *Chemical Reviews*, v. 59, no. 4, Aug. 1959, p. 583-628.

**11412 Reaction Mechanisms in Organometallic Compounds. Comparative Solvolyses of Organotin and Organosilicon Chlorides.** Behaviors of Sn and Si have been compared in solvolysis and hydrolysis of the triisopropyl halides in propan-2-ol. ***R. H. Prince.*** *Chemical Society, Journal*, 1959, May, p. 1783-1790.

**11413 The Behaviour of Ammonia in Gas Chromatography. I. Ammine Formation in Columns Containing Solutions of Silver Nitrate in Benzyl Cyanide.** ***L. A. Du Plessis and A. H. Spong.*** *Chemical Society, Journal*, 1959, June, p. 2027-2031.

**11414 An Additive Function of Entropy of Boiling, and the Prediction of Latent Heat of Vaporisation and Vapour Pressure of Liquids.** Treatment leads to a plausible correlation of molecular structure and internal order in the liquid state. ***Leo H. Thomas.*** *Chemical Society, Journal*, 1959, June, p. 2132-2152.

**11415* Study of the Mechanism of the Reactions of 2/3 Order in the Kinetics of the Endothermal Decomposition of Pulverulent Solids. Hypothesis of Spherical Grains.** (*In French.*) Étude du mécanisme des réactions d'ordre 2/3 en cinétique de décompositions endothermiques de solides pulvérulents. Hypothèse des grains sphériques. ***Pierre Barret, Rodolphe de Hartoulari, and René Perret.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 248, no. 20, May 20, 1959, p. 2862-2864.

**11416 The Determination of Molecular Structure.** An introductory survey of the main physico-chemical methods that have been devised for the determination of molecular structures. Spectroscopic, diffraction, and miscellaneous other methods. ***P. J. Wheatley.*** 263 pp. 1959. Oxford University Press, London. (QD471 W56d)

**11417 On an Ion-Exchange Property of Manganese Dioxide.** When $MnO_2$ is shaken with an electrolyte solution, the cation is adsorbed and H ion is released: an ion exchange reaction takes place on the surface of the $MnO_2$. A simple method based on Zn ion exchange reaction is proposed to measure ion exchange capacity of various Mn dioxides. ***Akiya Kozawa.*** *Electrochemical Society, Journal*, v. 106, July 1959, p. 552-556.

**11418 Electronic Theory and Chemical Reaction—An Elementary Treatment.** Discusses electronic theory of valency as applied to behavior of compounds and mechanisms of chemical reactions. ***R. W. Stott.*** 4th Ed. 112 pp. 1958. Longmans, Green and Co., New York. (QD501 St76e4)

**11419 The Physical Properties of Some Fluorine Compounds and Their Solutions. IV. Solutions in Hydrocarbons.** The systems perfluorocyclohexane + cyclohexane, perfluoromethylcyclohexane + methylcyclohexane, and perfluorocyclohexane + 1,3,5-trimethylcyclohexane were studied from 40-70 C. ***D. E. L. Dyke, J. S. Rowlinson, and R. Thacker.*** *Faraday Society, Transactions*, v. 55, June 1959, p. 903-910.

**11420 The Kinetics of the Exchange Reaction $CH_3 + CH_4 \rightarrow CH_4 + CH_3$ Using $^{14}C$ as Tracer.** ***F. S. Dainton, K. J. Ivin, and F. Wilkinson.*** *Faraday Society, Transactions*, v. 55, June 1959, p. 929-936.

**11421 The Pyrolysis of *tert.*-Butanol.** Thermal decomposition of *tert.*-butanol in the gas phase was investigated between 487 and 620 C and the reaction kinetics followed by pressure change and by analysis. ***J. A. Barnard.*** *Faraday Society, Transactions*, v. 55, June 1959, p. 947-951.

**11422 The Investigation of Chemisorption and Catalyst Poisons by Radiochemical Techniques. II. Selective Catalyst Poisoning in the Hydrogenation of Cyclopropane and Propylene.** ***K. C. Campbell and S. J. Thomson.*** *Faraday Society, Transactions*, v. 55, June 1959, p. 985-991.

**11423 The Heat of Wetting of Carbon Black and Mineral Powders by Benzene and Related Hydrocarbons.** Heats of wetting of carbon black, silica, $BaSO_4$, and $CaCO_3$ were measured for the liquids cyclohexane, benzene, cyclohexene, and 1-methylcyclohexene, and from them the heats of adsorption were calculated. ***D. J. Hine and W. C. Wake.*** *Faraday Society, Transactions*, v. 55, June 1959, p. 1017-1024.

**11424* Infra-Red Absorption Spectra of Humic Acid and Alkali Treated Humic Acid.** Chemical structure of humic acid was investigated by observing the infra-red absorption spectrum of humic acid from peat. A model structure of humic acid is presented. (*In Japanese.*) ***Shuya Fujii.*** *Fuel Society of Japan, Journal*, v. 38, no. 384, Apr. 1959, p. 267-273.

**11425 Induced Oxidation.** A monograph on the phenomena connected with induced oxidation; chemical, technical, and biochemical aspects. ***W. P. Jorissen.*** 208 pp. 1959. Elsevier Publishing Company, New York. (QD501 J76i)

**11426* Ion Exchange From Electrolyte Mixtures.** An investigation of the kinetics of the exchange process of H ion into Na ion from electrolyte mixtures. With increase in concentration, the complete exchange decreases in contrast to the inverse ratios occurring during the exchange from the solution of the individual electrolytes. (*In Russian.*) Ionnyĭ obmen iz smeseĭ elektrolitov. ***V. M. Barboĭ, M. T. Lysenko, G. I. Chuprina, and A. V. Iudin.*** *Izvestiia Vysshikh Uchebnykh Zavedeniĭ, Tekhnologiia Legkoĭ Promyshlennosti*, 1959, no. 1, p. 72-80.

**11427* Carbon-Hydrogen-Acetylene Equilibrium at High Temperatures.** Concentration of acetylene in equilibrium with C and H at temperatures up to 3000 K was measured experimentally using water-cooled quenching probes in a C tube furnace. ***Myron N. Plooster and Thomas B. Reed.*** *Journal of Chemical Physics*, v. 31, July 1959, p. 66-72.

**11428* Thermodynamic Properties of Nitryl Chloride.** Calorimetric heat of formation of gaseous nitryl chloride from the elements at 25 C has been found from the heat of reaction of gaseous nitryl chloride with nitric oxide as confirmed by the heat of reaction between nitrosyl chloride and $N_2O_5$. ***James D. Ray and Richard A. Ogg, Jr.*** *Journal of Chemical Physics*, v. 31, July 1959, p. 168-171.

**11429 Detonation Propagation in Liquid Ozone-Oxygen.** Velocities and approximate composition limits of detonation propagation were determined for the liquid $O_3$-$O_2$ system at −177 C. ***Riley O. Miller.*** *Journal of Physical Chemistry*, v. 63, July 1959, p. 1054-1057.

**11430 Effects of Interparticle Condensation on Heats of Adsorption and Isotherms of Powder Samples.** Additional heat of immersion measurements for graphite in benzene confirm a previous conclusion that there is extensive capillary condensation in voids between particles when powder samples adsorb vapor at high relative pressure. ***Conway Pierce.*** *Journal of Physical Chemistry*, v. 63, July 1959, p. 1076-1079.

**11431 Surface Properties of Germanium.** Physical and chemical properties of Ge films sputtered by a discharge in an inert atmosphere. ***Y. L. Sandler and M. Gazith.*** *Journal of Physical Chemistry*, v. 63, July 1959, p. 1095-1102.

**11432 Thermochemistry and Vapor Pressure of Aliphatic Fluorocarbons. A Comparison of the C-F and C-H Thermochemical Bond Energies.** Heat of formation of four organic fluorine compounds, including three completely fluorinated aliphatic compounds, was determined by a rotating-bomb method of combustion calorimetry. ***W. D. Good, et al.*** *Journal of Physical Chemistry*, v. 63, July 1959, p. 1133-1138.

**11433 Adsorption of Inert Gases by Modified Carbons.** Adsorption of N and Ar by modified active carbons has been studied by a simple desorption technique. ***W. F. Wolff and Philip Hill.*** *Journal of Physical Chemistry*, v. 63, July 1959, 6. 1161-1164.

**11434* On the Process of Development of Crystallization Centers of Supercooled Organic Liquids.** An interpretation is given of the empirical relationship previously obtained by the author; namely, the number of crystallization nuclei originating at a given temperature and developed at a higher temperature decreases. The interpretation is based on the kinetic laws of formation of crystallization centers on impurity particles. (*In Russian.*) O protsesse proiavleniia tsentrov kristallizatsii pereokhlazhdennoi organicheskoĭ zhidkosti. ***G. L. Mikhnevich.*** *Kolloidnyĭ Zhurnal*, v. 21, no. 3, May-June 1959, p. 325-329.

**11435* Surface Activity Studies of Tungsten Trioxide Powders.** Adsorption measurements of $WO_3$ powders; construction of adsorption apparatus; preparation of sintered W bars from $WO_3$; relationship between basic material and structure of sintered bars. (*In German.*) Untersuchungen zur Oberflächenaktivität von Wolframtrioxyd-Pulvern. ***Will Kleber and Dieter Radloff.*** *Neue Hütte*, v. 4, June 1959, p. 323-328.

**11436 Physical Properties of Chemical Compounds. II.** Systematic tabular presentation of accurate data on the physical properties of 476 organic straight-chain compounds. These comprehensive and basic data were determined for specially prepared high purity compounds. In addition to the precisely measured properties, the author has calculated new values for many constants based upon his new experimental values. ***R. R. Dreisbach.*** 491 pp. 1959. American Chemical Society, Washington, D. C. (QD291 D81p)

**11437 Crystal Structural Properties of Carbon Blacks.** The crystal size and amount of disorganized C were studied in a number of carbon blacks, with respect to different pyrolysis processes and fuels. The residual H content is related to the variation in structure and process. The structure of the carbon black is described in terms of the per cent of disorganized C, of parallel graphitic layers, and non-parallel layers. ***A. E. Austin.*** Paper from "Proceedings of the Conference on Carbon", Pergamon Press, Inc. 1959, p. 389-403. (QD181.C1 C76p)

**11438 Annealing of Crystal Distortion in Irradiated Graphite.** Fast neutron irradiation damage to crystallites of artificial graphite was observed by means of X-ray diffraction techniques. The intralayer distortions and crystal spacing recover at lower annealing temperatures than do the interlayer distortions. The nature of the intralayer distortions was studied by Fourier analysis of line shape. It was concluded that this distortion is principally an inhomogeneous strain and that there is little crystal breakup for irradiations less than 1000 MWd/ton. ***A. E. Austin and R. J. Harrison.*** Paper from "Proceedings of the Conference on Carbon", Pergamon Press, Inc. 1959, p. 585-605. (QD181.C1 C76p)

**11439 Proceedings of the Third Conference on Carbon.** Held at the University of Buffalo, Buffalo, New York, June 17-21, 1957. Aspects of the subject covered are solid state physics, chemistry of solid C compounds and reactions, radiation effects, and studies of the properties of resulting products as a function of processing variables. Survey of current C problems. 718 pp. 1959. Pergamon Press, New York. (QD181.C1 C76p)

**11440* Molecular Rotation and Migration in Crystals.** Behavior of the pure solids formed by *molecules globulaires* and of the solid solutions which they form down to temperatures considerably below the melting point, with respect to the number and nature of transitions in the solid state. ***J. G. Aston.*** *Record of Chemical Progress*, v. 20, no. 2, June 1959, p. 41-55.

**11441* Electrolytes in Sulphuric Acid.** Physical properties of 100% $H_2SO_4$; the sulphuric acid solvent system; freezing points and osmotic coefficients; electrical conductivities; apparent molar volumes; viscosities. ***R. J. Gillespie.*** *Reviews of Pure and Applied Chemistry*, v. 9, no. 1, Mar. 1959, p. 1-32.

**11442 The Bromination of 2-Carbethoxycyclopentanone at Low Temperatures.** ***J. R. Hulett.*** *Royal Society, Proceedings*, v. 251, ser. A, May 26, 1959, p. 274-281.

**11443* Crystal Structure Studies on Some Basic Salts of $Ce^{IV}$, $Th^{IV}$, $U^{IV}$, $Ti^{IV}$ and $Zr^{IV}$.** Previously published crystal structure determinations are reviewed briefly. The relations between the oxide or hydroxide complexes in crystals and the structures of the corresponding dioxides are discussed. ***Georg Lundgren.*** *Svensk Kemisk Tidskrift*, v. 71, no. 4, 1959, p. 200-220.

**11444 The Heats of Combustion of Some Rare-Earth Metals.** A bomb calorimeter for measuring the heats of combustion of Nd, Sm, Gd, and Er is described. The heats of combustion of these metals and the heats of formation of their oxides are reported. ***F. H. Spedding, R. E. Eberts, and A. W. Naumann.*** *U. S. Atomic Energy Commission, ISC-934*, May 15, 1959, 13 pp. (UF767 Un3.1is Contin.)

**11445 Equilibrium Study of the System Potassium Carbonate, Potassium Bicarbonate, Carbon Dioxide, and Water.** Equilibrium data cover the operating range of the hot carbonate scrubbing system for removing $CO_2$ from gas mixtures. ***J. S. Tosh, J. H. Field, H. E. Benson, and W. P. Haynes.*** *U. S. Bureau of Mines Report of Investigations* 5484, 1959, 23 pp. (TN21 Un3r Vis.)

**11446* Kinetics of Gas Reactions in Flow Systems.** Factors controlling the velocity of gas reactions in flow systems with a solid catalyst and without it. Kinetic equations for some simple cases. Validity of these equations is illustrated with a few examples chosen among the recent publications. (*In Polish.*) Kinetyka reakcji gazowych w strumieniu. ***Stanisław Ciborowski and Edward Józefowicz.*** *Wiadomości Chemiczne*, v. 13, May 1959, p. 257-269.

**11447* The Photochemical Reduction of Thionine. III. The Effect of Fluoride on the Photochemical Thionine-, Selenine-, 2,7-Diaminophenoxazime- and Methylene Blue-Ferroion System.** Between the redoxpotential difference of the dye systems and the $Fe^{+++}/Fe^{++}$ system and the photochemical sensitivity there is no direct relationship. When the redoxpotential difference increases, the speed of the dark reaction increases also. The reaction is stopped by the addition of fluoride. This effect of fluoride is eliminated partly by means of acetone. (*In German.*) Die photochemische Reduktion des Thionins. III. Der Einfluss von Fluorid auf das photochemische Thionin-, Selenin-, 2-7-Diaminophenoxazim- und Methylenblau-Ferroionensystem. ***R. Havemann and H. Pietsch.*** *Zeitschrift*

*für Physikalische Chemie* (Leipzig), v. 210, nos. 5-6, May 1959, p. 232-245.

**11448* The Physical Chemistry of Concentrated Ozone. V. Determination of the Dielectric Constant of Liquid Ozone and of Its Solutions in Oxygen.** Dielectric constant was determined by the method of capacity measurement of a condenser filled with the unknown substance. Measurements were made with a specially devised remote control arrangement of which the readings were independent of the line and sensor insulation over the range 100 meg. to 20 kohms. (*In Russian.*) Fiziko-khimiia kontsentrirovannogo ozona. V. Opredelenie dielektricheskoĭ pronitsaemosti zhidkogo ozona i ego rastvorov v kislorode. ***E. N. Pitskhelauri and V. V. Iastrebov.*** *Zhurnal Fizicheskoĭ Khimii,* v. 33, no. 4, Apr. 1959, p. 790-792.

**11449* Investigation of the Constant of Electrolytic Dissociation of Allyl-*O*-Toluidine Thiocyanate in Water, Water-Alcohol Solvents and in Absolute Alcohol.** The constant was found to decrease on passing from absolute alcohol to water. (*In Russian.*) Issledovanie konstanty elektroliticheskoĭ dissotsiatsii rodanistovodorodnogo allilortotoluidina v vodno-spirtovykh rastvoriteliakh. ***A. N. Borisevich and S. P. Miskidzh'ian.*** *Zhurnal Fizicheskoĭ Khimii,* v. 33, no. 4, Apr. 1959, p. 840-843.

**11450* The Equation of State of Freon-41 (Methyl-fluoride).** Equation holds for densities from zero to 0.8 critical and is suitable for determining both thermal as well as caloric values of Freon-41 for any practically required temperatures. (*In Russian.*) Uravneniia sostoianiia freona-41 (metilftorida). ***Ia. Z. Kazavchinskiĭ and G. I. Tsoĭman.*** *Zhurnal Fizicheskoĭ Khimii,* v. 33, no. 5, May 1959, p. 992-996.

## COATINGS

**11451 The Use of Platy Wet Ground Mica in Fire-Retardant Paints.** ***Max Kronstein, Joseph A. Castronovo, Jr., and Victor J. Cordones.*** *American Paint Journal,* v. 43, June 22, 1959, p. 86 + 9 pages.

**11452 High-Softening-Point Maleic-Modified Tall Oil Rosin Glycerol Esters.** When maleic is first pre-esterified with glycerol and then reacted with rosin in the presence of a small amount of phosphoric acid, considerably higher softening points are obtained. Under these conditions, tall oil rosin gives resins with softening points at least as high as gum rosin. ***R. D. Bitting and E. E. McSweeney.*** *American Paint Journal,* v. 43, July 13, 1959, p. 30 + 4 pages.

**11453 A New Method for Determining the Wet Adherence of Supported Films to Various Bases.** Method employs a pebble mill charged with pebbles and fine quartz in liquid medium. Exposed film or paper specimens are placed in mill and abraded. Specimens are checked in optical dosimeter. The "coefficient of abrasion" is measure of the wet abrasion resistance of sample. ***Arthur S. Diamond.*** *American Paint Journal,* v. 43, July 20, 1959, p. 70 + 11 pages.

**11454 Hardfacing With Cobalt-Base Alloys.** Hardfacing ranks as a precision process and of the many alloys available for hardfacing by welding, none are more versatile than those of the Co-base type. Discusses composition and properties, structure, heat, corrosion and abrasion resistance, oxy-acetylene, arc, Ar arc, atomic H, submerged arc, powder welding, and hardfacing problems. ***G. Grainger.*** *Cobalt,* no. 3, June 1959, p. 3-15.

**11455* Synthetic Pipeline Coatings.** Eight systems are studied. The properties of thin film synthetic coatings, when properly selected, meet the necessary requirements for pipeline protection and may be competitive with the materials presently used. ***M. J. Dabney, O. C. Slotterbeck, and D. F. Koenecke.*** *Gas Age,* v. 124, July 23, 1959, p. 28-34.

**11456* Dyed Anodised Aluminium.** Anodised Al is often dyed in hot or boiling solutions of dye-stuff; but good—or even better—results are obtained with cold dyebaths. *Industrial Finishing, (London),* v. 11, June 1959, p. 20 + 2 pages.

**11457* Sprayed Plastics for Coating Metals.** Present methods for applying plastic coatings to metals are powder spraying, powder dipping, flame spraying, the solution or dispersion method. The advantages of plastic coatings are; rapidity of application, corrosion resistance, freedom from porosity. ***D. E. J. Cunningham.*** *Industrial Finishing (London),* v. 11, June 1959, p. 29 + 3 pages.

**11458 Hard-Surfacing Shaker Screens for Uranium Mines.** Construction of the shaker screen is described. ***G. Giangrande.*** *Machinery (London),* v. 95, July 1, 1959, p. 16-17.

**11459 Tough, Chemical Resistant Urethane Coatings.** High resistance to water, chemicals, solvents, and weathering; high resistance to wear and shock, and high dielectric properties are shown. ***R. S. Sansone.*** *Materials in Design Engineering,* v. 49, June 1959, p. 80-83.

**11460 Anti-Friction Coatings of Sprayed Pseudo-Alloys.** Development of new anti-friction materials to replace bearing bronzes and other bearing alloys in sliding bearings by making use of the electric metal spraying process. ***L. V. Krasnichenko.*** *Metal Industry,* v. 94, June 5, 1959, p. 461-463.

**11461 Effect of Surface Impregnation of (TiC-Base) Hard Metals on Their Scaling Resistance.** Impregnation of TiC-NiAl hard metals with Be increases their oxidation resistance about 20-fold. ***V. P. Elyutin, E. I. Mozzhukin, and V. I. Shulepov.*** *Henry Brutcher Translation No.* 4592, 9 pp. (From *Proizvodstvo i Obrabotka Stali i Splavov.* Collection of Papers No. 38 from the Moscow Steel Institute. *Metallurgizdat,* 1958, p. 427-432.) Henry Brutcher, Altadena, Calif.

**11462* Effect of Particle Size Distribution of Pigment and Pigment Volume Concentration on Flat Wall Paint Properties (Solvent Type).** ***Robert F. Hall.*** *Official Digest,* v. 31, June 1959, p. 788-799.

**11463* Silicone Additives for Paint.** Excellent heat resistance and weathering properties are incorporated into clear and pigmented varnishes by silicone additives. ***R. C. Hedlund and K. R. Meath.*** *Paint and Varnish Production,* v. 49, no. 7, June 1959, p. 43-47.

**11464* Water Absorption and Salt-Fog Resistance of Corrosion Inhibiting Paints.** ***Henry F. Payne.*** *Paint and Varnish Production,* v. 49, no. 8, July 1959, p. 29 + 7 pages.

**11465* Surface Coating Vehicles With Built-In Fungistats.** Vehicles are based on tung oil and contain chemically-combined, potentially fungistatic acids. Tung oil-tripropionin paint formulation out-performed all others tested. ***Leo A. Goldblatt, Lucien L. Hopper, and Ruth Y. Mayne.*** *Paint and Varnish Production,* v. 49, no. 8, July 1959, p. 44 + 3 pages.

**11466* Aluminum Pigments for Industrial Finishes.** Aluminum based metallic coatings are being used to a greater degree to finish articles of manufacture or in industrial finishing. ***Ernest Scheller, Jr.*** *Paint Industry Magazine,* v. 74, June 1959, p. 8 + 3 pages.

**11467* Water-Soluble Vehicles in Industrial Finishes.** *Paint Industry Magazine,* v. 74, July 1959, p. 6 + 2 pages.

**11468* Zirconium Driers in Architectural Finishes.** Drier selection; influence of driers on film characteristics, and the drying mechanism. ***Charles A. Burger.*** *Paint Industry Magazine,* v. 74, July 1959, p. 15-19.

**11469 Polishing Cellulose and Polyester Lacquers.** Traditional methods need modification and adaptation to suit the properties of polyesters. ***W. Burkart.*** *Paint Manufacture,* v. 29, July 1959, p. 233-234.

**11470 Silicones Improve Wax Polishes. I.** Easier application, higher gloss, and decrease in smear are among the advantages of incorporating silicones. ***A. Morton and T. W. Watson.*** *Paint Manufacture,* v. 29, July 1959, p. 238-243.

**11471 Anticorrosive and Marine Paints.** A review. ***J. C. Kingcome.*** *Paint Manufacture,* v. 29, July 1959, p. 245-248.

**11472 Coating of Graphite With Silicon Carbide by Reaction With Vapor of Controlled Activity.** Thermodynamic conditions were determined for the formation of SiC, free of elemental Si. Although a wide range of pressure-temperature-composition conditions was explored, it was not possible to

duplicate the success previously obtained in applying the method to NbC, TaC, TiC, and ZrC coatings. ***John M. Blocher, Jr., Don P. Leiter, Jr., and Robert P. Jones.*** *U. S. Atomic Energy Commission, BMI*-1349, June 15, 1959, 15 pp. (UF767 U3b Contin.)

**11473* New Investigations on Vapor Phase Inhibitors.** Tests with VPI impregnated wrapping paper in touch with the metal surface show that this method may be applied to cast iron also. (*In German.*) Neue Untersuchungen auf dem Gebiete der Dampfphasen-Inhibitoren. ***Leo Cavallaro and Giorgio Mantovani.*** *Werkstoffe und Korrosion,* v. 10, July 1959, p. 422-425.

**11474* Corrosion Protection by Paint Systems, as Appraised by Statistics and Exemplified by Some Prominent Steel Structures.** (*In German.*) Korrosionsschutz durch Anstriche im Spiegel der Statistik und am Beispiel einiger markanter Stahlbauwerke. ***K. A. van Oeteren-Panhäuser.*** *Werkstoffe und Korrosion,* v. 10, July 1959, p. 442-445.

**11475 Hardsurfacing Can Increase Life of Tool Joints and Drill Collars.** Describes recommended pattern for surfacing. ***Raymond R. Fayer.*** *World Oil,* v. 149, Aug. 1959, p. 68-71.

***See also:*** **11259** (water soluble gums); **11265** (electric drying); **11538** (printed circuit coatings); **11804** (chromate treatments).

## CONTROL SYSTEMS, COMPUTERS, AND SYSTEMS ENGINEERING

**11476* Memory Core Control and Sorting Apparatus for Quantity Production.** Two basic ideas distinguish these instruments from known designs: Use of relays instead of electron tubes for generating current pulses, and multiplex operation (one electronic system instead of several electromechanical machines). Rate of automatic sorting can reach four cores per second. (*In French.*) Appareillage de contrôle et classement en grande production des microtores a mémoire. ***J. Riethmuller.*** *Annales de Radioélectricité,* v. 14, no. 56, Apr. 1959, p. 156-168.

**11477* A Visit to Computation Centers in the Soviet Union.** ***John W. Carr, III, Alan J. Perlis, James E. Robertson, and Norman R. Scott.*** *Association for Computing Machinery, Communications,* v. 2, June 1959, p. 8-20.

**11478* Pilot—A New Multiple Computer System.** The Pilot data processor is a high-speed multiple computer system, more than 100 times faster than SEAC. It contains three interconnected computers for rapid processing of data, and also contains multiple input-output channels for rapid transfer of data into and out of the system. All of these units operate concurrently in a coordinated fashion. A summary description is given of the over-all logical plan of the system. ***A. L. Leiner, W. A. Notz, J. L. Smith, and A. Weinberger.*** *Association for Computing Machinery, Journal,* v. 6, no. 3, July 1959, p. 313-335.

**11479* Modern Developments in Control.** Up to now there has been considerable talk about computers on the production line but little application. With intensive research, the first stages of application are now being made. ***Joseph F. Manildi.*** *Automation,* v. 6, July 1959, p. 70-76.

**11480* Electrohydraulic Servo Valve Systems.** Electrohydraulic servo valve systems provide a convenient means for linking electronic control to hydraulic power for fast and precise closed loop control of machine element position, speed, and acceleration. ***R. J. Render.*** *Automation,* v. 6, July 1959, p. 80-85.

**11481 Automation Cybernetics, and Society.** A social approach to automation, stressing the change of outlook, the new concepts, the different forms of creative thinking which are now being brought to bear upon problems of living in an organized society. Some space is devoted to engineering aspects, to the effect of new ways of thinking upon the individual, and to the use of machine models for their general value to psychology and to other biological sciences. ***F. H. George.*** 280 pp. 1959. Philosophical Library, New York. (T59.5 G29a)

**11482 Variable-Length Binary Encodings.** Gives a theoretical treatment of several properties which describe certain variable-length binary encodings of the sort which could be used for the storage or transmission of information. Some of these, such as the prefix and finite delay properties, deal with the time delay with which circuits can be built to decipher the encodings. The self-synchronizing property deals with the ability of the deciphering circuits to get in phase automatically with the enciphering circuits. ***E. N. Gilbert and E. F. Moore.*** *Bell System Technical Journal,* v. 38, no. 4, July 1959, p. 933-967.

**11483 Representation of Switching Circuits by Binary-Decision Programs.** A binary-decision program is a program consisting of a string of two-address conditional transfer instructions. The paper shows the relationship between switching circuits and binary-decision programs, and gives a set of simple rules by which one can transform binary-decision programs to switching circuits. It then shows that, in regard to the computation of switching functions, binary-decision programming representation is superior to the usual Boolean representation. ***C. Y. Lee.*** *Bell System Technical Journal,* v. 38, no. 4, July 1959, p. 985-999.

**11484 Interconverting Frequency and Transient Response.** Interconversion of frequency and transient response is easy with the two sine and cosine cursors presented here. A six-step example shows that plotting one frequency-response graph and summing intercepts from the cursor is all that is needed to obtain transient response. ***H. H. Rosenbrock.*** *Control Engineering,* v. 6, July 1959, p. 116-120.

**11485 A Remarkable New Switching Form.** A device is described, which makes and breaks electrical circuits without the use of contacts. The "break" time of electrochemical relays can be varied to suit specific application requirements. For the present it can be said only that the electrochemical relay is static, simple, wearproof and it works. ***John D. Cooney.*** *Control Engineering,* v. 6, July 1959, p. 121-124.

**11486* Analog-Digital Converters.** Discusses general remarks on transducers, shaft position encoders, operation, means of reading discs, ambiguity, theory of V scanning, brush selecting logic, self-contained logic elements, multispeed binary coders, coupling coders to other components. *Electromechanical Design,* v. 3, no. 6, June 1959, p. 65 + 10 pages.

**11487* Some Studies in Machine Learning Using the Game of Checkers.** Two machine-learning procedures have been investigated in some detail using the game of checkers. Enough work has been done to verify the fact that a computer can be programmed so that it will learn to play a better game of checkers than can be played by the person who wrote the program. Furthermore, it can learn to do this in a remarkably short period of time (8 or 10 hours of machine-playing time) when given only the rules of the game. ***A. L. Samuel.*** *IBM Journal of Research and Development,* v. 3, no. 3, July 1959, p. 211-229 + 1 plate.

**11488* Experiments on the Relation of the Operator to the Control Loop of an Airborne Digital Computer.** Some laboratory experiments were performed over a period of three years to provide design information for digital computer systems for error correction in aircraft navigation. In a simulated digital control loop, the operator observed crosshair error and fed control signals to the computer. The studies showed relationships between recovery time and solution rate, transmission delays, hand-control sensitivity, sampling rate, and scanning rate. ***C. A. Bennett.*** *IBM Journal of Research and Development,* v. 3, no. 3, July 1959, p. 275-281.

**11489* A Learning Machine. II.** An effort is made to improve the performance of the learning machine described in Part I, and the over-all effect of various changes is considered. Comparative runs by machines without the scoring mechanism indicate that the grading of individual instructions can aid in the learning process. A related study is made in which auto-

matic debugging of programs is taken as a special case of machine search. ***R. M. Friedberg, B. Dunham, and J. H. North.*** *IBM Journal of Research and Development*, v. 3, no. 3, July 1959, p. 282-287.

**11490* Indexing and Control-Word Techniques.** In large-scale computers the details of data handling, such as indexing, transmission and ordering, may be performed either by programming or by built-in machine operations. An analysis of the most frequently performed functions justifies the expansion of single-valued index quantities to three-valued control words and the specification of built-in increment, count and refill operations to be used with these control words. ***G. A. Blaauw.*** *IBM Journal of Research and Development*, v. 3, no. 3, July 1959, p. 288-301.

**11491 Comparison of Lead Network, Tachometer, and Damper Stabilization for Electric Servos.** Types of compensation as lead network, tachometer feedback, and viscous-coupled-inertia damper are compared in such matters as servo bandwidth, velocity constant, torque constant, transient response, tolerance to gear-train backlash, noise, and required amplifier gain. ***George A. Biernson.*** *IRE Transactions on Automatic Control*, v. AC-4, no. 1, May 1959, p. 7-14. (TK1 In6.6ac Vis.)

**11492 The Analysis of Sampled-Data Control Systems With a Periodically Time-Varying Sampling Rate.** Method presented is straightforward and can be used to analyze any linear sampled-data system with a periodic sampling pattern. This method can also be used to obtain an approximate solution for the output of any linear system which is excited by a periodic but nonsinusoidal forcing function. In this analysis, only periodicity of the sampling pattern is assumed, and no relationship between individual sampling intervals is required. ***E. I. Jury and F. J. Mullin.*** *IRE Transactions on Automatic Control*, v. AC-4, no. 1, May 1959, p. 15-21. (TK1 In6.6ac Vis.)

**11493 On the Synthesis of Feedback Systems With Open-Loop Constraints.** Method is presented for synthesizing a feedback system under the constraints that the open-loop transfer function must have specified $K$, and contain real poles at prescribed locations. Method is based on examination of inverse root-locus plot for closed-loop poles and zeros. ***John A. Aseltine.*** *IRE Transactions on Automatic Control*, v. AC-4, no. 1, May 1959, p. 31-37. (TK1 In6.6ac Vis.)

**11494 An Analog Computer for Finding an Optimum Route Through a Communication Network.** This paper describes an analog computer capable of solving a variety of communication network problems; in particular, the problem of finding an optimum route through an arbitrary network. A 16-node multiply-connected prototype has been designed in which "time" is used as the analog of link weights. ***H. Rapaport and P. Abramson.*** *IRE Transactions on Communications Systems*, v. CS-7, no. 1, May 1959, p. 37-42. (TK1 In6.6cs Vis.)

**11495* The Cryosar—A New Low-Temperature Computer Component.** The cryosar is a high-speed two-terminal computer component whose operation, at liquid He temperature (4.2 K), is based on impact ionization of impurities in Ge. Two types of cryosars are discussed. The first can perform the functions of an ordinary diode; the bistable cryosar can be used as a memory element, multivibrator or flip-flop. ***A. L. McWhorter and R. H. Rediker.*** *I.R.E. Proceedings*, v. 47, July 1959, p. 1207-1213.

**11496* A Simplified Theory of Feedback Control Systems. XII.** Discussed are non-linear characteristics with odd and even symmetry, odd- and even-symmetric non-linear components. ***P. Naslin.*** *Process Control and Automation*, v. 6, June 1959, p. 273-277.

## ELECTRICAL ENGINEERING

**11497* The Theory of the Two-Wire Repeaters.** If the expanded transformation is used for the two-wire repeater with one amplifier for go and one for return direction, a two-wire repeater is obtained with two negative impedances in a bridge circuit. These two negative impedances are each generated by an amplifier that is made regenerative by way of a bridge circuit. (*In German.*) Zur Theorie der Zweidrahtverstärker. ***Theodor Grewe.*** *Archiv der Elektrischen Übertragung*, v. 13, June 1959, p. 243-252.

**11498* A Demonstration of Determination of Equivalent-Circuit Diagrams of Transformers.** In deducing equivalent circuits of transformers the starting point is as a rule the related equations, an equivalent circuit being synthesized from them. A method that allows a determination of equivalent circuits of transformers direct from the magnetic equivalent circuit. (*In German.*) Anschauliche Ermittlung von Transformator-Ersatzschaltbildern. ***Hans Edelmann.*** *Archiv der Elektrischen Übertragung*, v. 13, June 1959, p. 253-261.

**11499* The Distribution of Message Delays on Traffic Peaks.** This paper shows how in the case of a single serving trunk the delay distribution for the $n$-th message($n = 2,3$, etc.) can be determined for a constant message duration, if the first message arriving at the time $t_0 = 0$ has to wait a certain time $T$ and a traffic offered $A$ is on hand from the time $t_0$ onward. (*In German.*) Über die Verteilung der Wartezeiten bei Verkehrsspitzen. ***Horand Störmer.*** *Archiv der Elektrischen Übertragung*, v. 13, June 1959, p. 262-266.

**11500* The Safety of a Communications Circuit, for Which a Finite Frequency Band of Width Is Reserved.** Instead of purely white interference, the paper assumes that the communications circuit under consideration is distributed by some other transmitting station (spectral power density $n_t$), and that a finite frequency band of width $B$, being free of interference by other transmitting stations, be reserved to the communications circuit. (*In German.*) Über die Sicherheit einer Nachrichtenverbindung, der eine endliche Bandbreite reserviert ist. ***Hans Wolter.*** *Archiv der Elektrischen Übertragung*, v. 13, June 1959, p. 267-270.

**11501* Initial Production Reliability of Devices.** The paper deals with determination of initial production reliability which value is determined by the design peculiarities of the device and by production factors. Analytical relations are deduced for calculating reliability. Dependence of initial production reliability on specification factors of assurance is shown. Effect of additional control is considered. (*In Russian.*) Nachal'naia proizvodstvennaia nadezhnost' ustroĭstv. ***Ia. A. Rips.*** *Avtomatika i Telemekhanika*, v. 20, no. 6, June 1959, p. 813-822.

**11502 Research Model for Time-Separation Integrated Communication.** A new communication system concept, which is an important step toward an all-digital telecommunication plant, is discussed. A research model, called ESSEX (Experimental Solid State Exchange), which combines remote line concentration, time-separation switching, and PCM transmission, is introduced to demonstrate the concept. The model, which uses solid state devices, works at the speed of a full-size system. ***H. E. Vaughan.*** *Bell System Technical Journal*, v. 38, no. 4, July 1959, p. 909-932.

**11503 Recurrent Codes: Easily Mechanized, Burst-Correcting, Binary Codes.** A class of codes capable of correcting multiple errors is described. Some of these codes can be implemented with considerably less hardware than was needed for previous multiple error-correcting codes. A general method is shown for constructing a code of redundancy $1/b$ that will correct error bursts of $Kb$ or fewer digits ($K$ and $b$ integers). The logical design of the encoder and decoder, as well as the guard space requirement of good digits between bursts of errors, is described. ***D. W. Hagelbarger.*** *Bell System Technical Journal*, v. 38, no. 4, July 1959, p. 969-984.

**11504 Equilibrium Delay Distribution for One Channel With Constant Holding Time, Poisson Input and Random Service.** The equilibrium telephone delay distribution is found for a single-server queueing system with Poisson input, random service and constant holding time. Curves are presented for various occupancy levels, and these are compared with their queued-service constant-holding-time and random-service exponential-holding-time counterparts. ***Paul J. Burke.*** *Bell System Technical Journal*, v. 38, no. 4, July 1959, p. 1021-1031.

**11505 Electrical Machines. Direct & Alternating Current.** ***Charles S. Siskind.*** 2nd Ed. 563 pp. 1959. McGraw-Hill, New York. (TK2511 S81e2)

**11506* Continuous A.C. Oxidizing of the Anode Foil for Electrolytic Capacitors.** Dynamic forming of the anode foil for electrolytic condensers with A.C. is very useful with opposite wiring schemes of the baths. Baths must be made of stainless steel 1Kh18N9T. Highest stability of forming conditions is obtained by pulling one and the same foil through the baths connected together. (*In Russian.*) Nepreryvnoe oksidirovanie peremennym tokom anodnoĭ fol'gi dlia elektroliticheskikh kondensatorov. ***B. M. Tareev and M. M. Lerner.*** *Elektrichestvo*, 1959, no. 6, June, p. 71-76.

**11507* Silicone Electrical Insulation.** Fluids, compounds, rubbers, and resins are described. Applications and economic aspects, as well as desirable improvements in properties and processing requirements, are noted. ***J. H. Davis.*** *Institution of Electrical Engineers, Proceedings*, v. 106, pt. A, no. 27, June 1959, p. 193-205.

**11508* Methods of Measurement of Electrical Conductivity.** It is shown that the method of a rotating magnetic field can be used for the measurement of the electrical conductivity of substances not only in form of monolith samples, but also in powder form. It is possible to increase the sensitiveness of this method by two orders by use of the phenomenon of usonance for the loosening of the supporting structure. (*In Russian.*) O metodakh izmereniia elektroprovodnosti. ***S. F. Kozlovskiĭ.*** *Pribory i Tekhnika Eksperimenta*, 1959, no. 3, May-June, p. 110-113.

**11509* Application of Telegraph Techniques in Data Transmission.** The burgeoning of electronic computers as business machines has fostered increasing need of rapid interplant and intercity data transmission for which, as is well known, many conventional telegraph techniques are readily adaptable. Important new telegraph equipment items for data circuitry are carrier transceivers, loop transceivers, and network repeaters. ***Albert Boggs and J. Edwin Boughtwood.*** *Western Union Technical Review*, v. 13, no. 3, July 1959, p. 90-98.

***See also:*** **11228** (electromechanical properties of lead titanate zirconate); **11229** (dielectric absorption in titanates); **11527** (algebra of electronics); **12259** dielectric losses in polymers).

## ELECTROCHEMISTRY

**11510 Effect of Electroplating Conditions on Structure and Wear Resistance of Iron Deposits.** Studies to find the optimum conditions of electrolysis to produce dense, fine-grained and wear-resisting iron plates. ***Yu. N. Petrov.*** *Henry Brutcher Translation No.* 4450, 8 pp. (From *Metallovedenie i Obrabotka Metallov*, Dec. 1958, no. 12, p. 53-56.) Henry Brutcher, Altadena, Calif.

**11511 Anodic Behavior of Aluminum at Low Potentials.** Electrode potentials, differential capacities, and anodic polarization curves were determined for Al in $H_2SO_4$ solutions. ***J. V. Petrocelli.*** *Electrochemical Society, Journal*, v. 106, July 1959, p. 566-570.

**11512 Effects of Chloride on the Orientation of Nickel Deposits.** Effects of chloride ions in a Ni bath. Chloride ions generally counterbalance the outgrowth condition due to impurities and favor lateral growth; this is attributed to the desorption of the impurities from the cathode, which facilitates the electron-transfer process. ***B. C. Banerjee and A. Goswami.*** *Electrochemical Society, Journal*, v. 106, July 1959, p. 590-592.

**11513 On the Jet Etching of N-Type Si.** The rate of jet electropolishing of low resistivity n-Si is controlled by two factors: supply of injected minority carriers and rate of dissolution of the $SiO_2$ film. The current through the oxide changes from ionic to electronic, i.e., the Si becomes passive, if the oxide thickness increases beyond a critical value. The hold supply determines the amount of etching which can occur when the Si is not passivated by a thick oxide layer. ***Paul F. Schmidt and David A. Keiper.*** *Electrochemical Society, Journal*, v. 106, July 1959, p. 592-596.

**11514 The Anodic Oxidation of Zinc and a Method of Altering the Characteristics of the Anodic Films.** Preliminary work on anodizing Zn in a variety of alkaline solutions led to some smooth white or gray films. A detailed study was made of the anodic oxidation of Zn and Zn alloys in one electrolyte, the results of which suggest similarities but also some differences between anodic films on Al and on Zn. ***H. Fry and Marjorie Whitaker.*** *Electrochemical Society, Journal*, v. 106, July 1959, p. 606-611.

**11515 A Study of the Silver (1) Oxide-Silver (II) Oxide Electrode.** Data on the electrode potential of the silver II oxide electrode over the temperature range 20-30 C. ***James F. Bonk and Alfred B. Garrett.*** *Electrochemical Society, Journal*, v. 106, July 1959, p. 612-615.

**11516 The Temperature Coefficients of Electrode Potentials. The Isothermal and Thermal Coefficients—The Standard Ionic Entropy of Electrochemical Transport of the Hydrogen Ion.** ***A. J. DeBethune, T. S. Licht, and N. Swendeman.*** *Electrochemical Society, Journal*, v. 106, July 1959, p. 616-625.

**11517 Control of Electrodeposition Processes by Examination of the Deposits.** Methods for determining ductility, hardness, and stress. ***T. E. Such.*** *Electroplating and Metal Finishing*, v. 12, July 1959, p. 256-259.

**11518 Electroforming Waveguides.** Fabrication procedures. Properties and finish of the electro deposits and the various types of mandrels employed. ***J. R. Balmer and T. W. A. Bailey.*** *Electroplating and Metal Finishing*, v. 12, July 1959, p. 267-270.

**11519 A Lead-Tin-Barium Alloy for the Positive Grids of Lead/Acid Batteries.** Metallurgical examination of the deterioration of Pb alloy grids of acid batteries during service life reveals factors to be considered during new alloy development. A Pb-Sn-Ba was developed which gives the combination of castability, stiffness, creep strength, and resistance to strong anodic stress-corrosion demanded by manufacture and service. ***N. L. Parr, A. Muscott, and A. J. Crocker.*** *Institute of Metals, Journal*, v. 87, pt. 10, June 1959, p. 321-329.

**11520* Plating on Inconel.** Method for silver plating directly on Inconel-X turnbuckles, which are to be operated at a constant temperature somewhat below the melting point of silver. ***Ed Calderon.*** *Metal Finishing*, v. 57, July 1959, p. 64 + 1 page.

**11521* Science for Electroplaters. XLIX. Copper Plating.** ***L. Serota.*** *Metal Finishing*, v. 57, July 1959, p. 72 + 3 pages.

**11522 Modern Aspects of Electrochemistry. No. 2.** Theory of electrolytic solutions; physical chemistry of ion-exchange resins; molten electrolytes; anodic behavior of metals; electrochemistry of the semiconductor-electrolyte interface. ***J. O'M. Bockris, editor.*** 416 pp. 1959. Academic Press, New York. (QD553 B63m)

**11523* A Method for Determining Abrasion Resistance of Thick Anodic Coatings on Aluminum.** ***Bruce E. Deal.*** *Plating*, v. 46, July 1959, p. 823-827.

**11524* Studies on Electrolytic Refining of Zinc. V. Removal of Lead From Zinc Sulfate Solution With Xanthate or Tetramethyl Thiuramdisulfide. VI. Application of Xanthate or Tetramethyl Thiuramdisulfide to Purification Process of Leached Zinc Solution.** ***Seitaro Fukushima.*** *Tôhoku University, Science Reports of the Research Institutes, Ser. A. Physics, Chemistry, Metallurgy*, v. 11, no. 3, June 1959, p. 220-243.

**11525 Titanium Electrorefining: Cathode Studies and Deep Bath Deposition.** Describes an electrorefining cell from which cathode deposits up to 30 in. long can be produced. ***D. H. Baker, Jr. and J. R. Nettle.*** *U. S. Bureau of Mines Report of Investigations* 5481, 1959, 11 pp. (TN21 Un3r Vis.)

## ELECTRONICS

**11526* Field-Intensity Measurements in High-Frequency Fields. II. Method of Measurement With an Antenna as a Standard of Measurement.** Discussed are the types of antenna and the measurement of voltage by the tube-voltmeter, by the receiver with a calibrated attenuator pad and finally by way of substitution. (*In German.*) Feldstärkemessungen in Hochfrequenzfeldern. II. Verfahren zur Messung mit Antenne als Messnormal. ***Hans Fricke.*** *ATM; Archiv für Technisches Messen,* 1959, no. 280, May, p. 89-92.

**11527 The Algebra of Electronics.** Basic laws and fundamental principles starting with graphs of networks and relating Kirchhoff's law to Ohm's law clearly are discussed. Progresses clearly from loop-branch relations in tabular form into nodal analysis determinants and through Laplace's expansion of determinants by cofactors. ***Chester H. Page.*** 258 pp. 1958. D. Van Nostrand Company, Inc., Princeton, New Jersey. (QA401 P14a)

**11528* Propagation of Electromagnetic Waves in Completely Ionized Resistive Plasmas.** In the first part the transport equation is given. Equations established in Part I are then applied in Part II to study of principal types of electromagnetic waves ($\lambda > 1$mm) capable of being propagated in a completely ionized plasma. (*In French.*) Propagation des ondes électromagnétiques dans les plasmas complètement ionisés résistifs. ***J. M. Dolique.*** *Annales de Radioélectricité,* v. 14, no. 56, Apr. 1959, p. 107-141.

**11529* White-Noise Cross-Talk Meter, Type FD 692.** Describes measuring equipment to simulate the multiplex signal to be transmitted; method provides a high precision measurement of the ratio signal/noise plus cross-talk in a telephone channel, for a fully loaded link. (*In French.*) Un diaphonomètre a bruit blanc: le F.D. 692. ***R. Grit and G. Levaillant.*** *Annales de Radioélectricité,* v. 14, no. 56, Apr. 1959, p. 142-155.

**11530* Non-Linear Distortion Including Cross Modulations in High-Frequency Transistor Amplifiers.** With a transistor-fourpole the grounded base connection at short-circuited output is considered as a first case, neglecting extrinsic elements. Carrier transport in the transistor is assumed to be uniquely due to diffusion. Thus, the calculations are restricted to small current densities. They are based on the differential equations of diffusion. Calculations lead to expressions for nonlinear effects of grounded emitter h. f. amplifiers. (*In German.*) Nichtlineare Verzerrungen einschliess lich Kreuzmodulation in Hochfrequenz-Transistorstufen. ***Metin Akgün and Max J. O. Strutt.*** *Archiv der Elektrischen Übertragung,* v. 13, June 1959, p. 227-242.

**11531 Antennas for Space Vehicles.** New concepts for antennas, such as the spherical equiangular spiral, promise to extend space communication range greatly. ***Maurice G. Chatelain.*** *Astronautics,* v. 4, July 1959, p. 44 + 3 pages.

**11532* Use of Hall-Elements as Phase-Sensitive Detectors.** The operation of the phase-sensitive detectors based on the Hall-effect is analyzed. Some principal relations are derived. The simple graphical method is suggested for proper choice of the elements to compensate the dependence of the Hall-element parameters on the surrounding temperature. The experimental data for three different phase-sensitive detectors are presented. (*In Russian.*) Primenenie datchika E. D. S. kholla v kachestve fazochuvstvitel'nogo vypriamitelia. ***B. N. Bogomolov and V. A. Miasnikov.*** *Avtomatika i Telemekhanika,* v. 20, no. 6, June 1959, p. 799-807.

**11533 Two-Terminal p-n-p-n Switches.** The described transistor is a regenerative switch. Its essential element is a crystal of Si which has four alternating conductivity sections. The transistor can act as a reversed and as a forward biased p-n diode dependent on the junction interaction. ***J. M. Goldey.*** *Bell Laboratories Record,* v. 37, June 1959, p. 223-226.

**11534 A Method of Coding Television Signals Based on Edge Detection.** A method is described for transmitting digitalized video signals to reduce channel capacity from that needed for standard PCM. This method takes advantage of the inability of the human eye to notice the exact amplitude and shape of short brightness transients. The transmitted information consists of the amplitudes and times of occurrence of the "edge" points of video signals. ***Bela Julesz.*** *Bell System Technical Journal,* v. 38, no. 4, July 1959, p. 1001-1020.

**11535* The Application of Magnetic Resonance to Solid State Electronics.** Paper first describes basic principles and techniques of magnetic resonance experiments, and then outlines four recent applications: "Hyperfine Structure and the Analysis of Impurities"; "Cyclotron Resonance of Current Carriers"; "Maser Developments from Paramagnetic Resonance"; and "Mavar Developments from Ferromagnetic Resonance". ***D. J. E. Ingram.*** *British Institution of Radio Engineers, Journal,* v. 19, June 1959, p. 357-367.

**11536* Multiplicative Receiving Arrays.** Performance of arrays in which outputs from two groups of elements or sections are multiplied together is studied from the points of view of directional patterns, directional discrimination and signal/noise performance. ***V. G. Welsby and D. G. Tucker.*** *British Institution of Radio Engineers, Journal,* v. 19, June 1959, p. 369-382.

**11537 A Synchronous Switch for Use With the Cathode Ray Oscillograph.** A description of a switch that extends the range of usefulness of the cathode ray oscillograph (CRO) in viewing transient phenomena in electrical circuits by means of a repetitive trace on the CRO is given. ***D. K. Reitan.*** *Electrical Engineering,* v. 78, July 1959, p. 749-751.

**11538* Protective Coatings for Missile Printed Circuits.** This report provides data on the formulation and characteristics of several coatings specially developed for missile printed circuits. Epoxy and silicone types appear to be particularly advantageous. Test procedures are also detailed. ***A. E. Hawley and W. E. Weber.*** *Electrical Manufacturing,* v. 63, June 1959, p. 58-62.

**11539 Uniform Resistivity p-Type Silicon by Zone Leveling.** Silicon single crystals nominally 1 cm in diameter and 16 cm long have been grown with Al doping in a floating zone apparatus. Crystals have been prepared with nominal p-type resistivities of 0.3 and 5 ohm-cm with variations of 5% or less along the crystal length. ***E. D. Kolb and M. Tanenbaum.*** *Electrochemical Society, Journal,* v. 106, July 1959, p. 597-599.

**11540* Environmental Testing. II.** Discusses radio interference, environmental test chambers, vibration and acoustic noise testing. *Electromechanical Design,* v. 3, no. 6, June 1959, p. 49 + 9 pages.

**11541* Transistor Data Chart.** For audio, h.f. power, high- and low-level switching units. *Electronic Design,* v. 22, no. 15, July 22, 1959, p. 49-72.

**11542 A Transistor Characteristic Curve Tracer.** A Dekatron is used to develop a stepped voltage controlling the base current of the transistor under test. At each step a half sinusoidal voltage is applied to the transistor and the resulting collector current is plotted against voltage on an external oscilloscope. A series resistor provides the current signal and limits the transistor dissipation. ***J. F. Young.*** *Electronic Engineering,* v. 31, June 1959, p. 330-336.

**11543 A Miniature Electroencephalograph Telemeter System.** A telemeter system is described which enables the electrical activity of the brain of a normal free and unrestrained cat to be recorded. The voltage picked up by an electrode fixed into the skull is amplified sufficiently to modulate a transmitter carried on the cat's back. ***D. C. Gold and W. J. Perkins.*** *Electronic Engineering,* v. 31, June 1959, p. 337-339.

**11544 The Design of Biased Diode Function Generators.** The design of biased diode function generators is considered and equations are derived relating the number of diode sections, minimum error obtainable, and spacing of the diode section to give this minimum error. The construction of a sine function generator, using these principles, is dealt with in some detail. ***C. C. Ritchie and R. W. Young.*** *Electronic Engineering,* v. 31, June 1959, p. 347-351.

**11545 An Electronic Timer With Voltage Control of Setting.** This timer (which is believed to be new in principle) is a development of the creeping cathode-follower, or Bootstrap circuit. The difference lies in providing a power drive to the grid, to give a constant but easily adjustable rate of change over the full operating grid control range of the valve. ***R. Gladstone.*** *Electronic Engineering*, v. 31, June 1959, p. 362-363.

**11546 Communications of the Future.** Magnetic storms destroy communications. Antennas in outer-space communications systems will act as radiotelescopes, and the incidence of galactic noise becomes a serious problem. Cosmic noise is by no means constant. ***Frank Leary.*** *Electronics*, v. 32, no. 27, July 3, 1959, p. 37-41.

**11547* Some Properties of Experimental 1000-Mc Transistors.** Experimental transistors designed to operate above 1000 Mc are described and measurements of their electrical parameters discussed. The design is a diffused-base drift transistor structure with minimized bulk resistances and junction capacitances. Measurements of the short-circuit current gain ($-h_{21b}$) with both emitter and collector reverse-biased, indicated that the passive circuit comprising extrinsic parameters only could produce a gain greater than unity. ***R. F. Rutz and D. F. Singer.*** *IBM Journal of Research and Development*, v. 3, no. 3, July 1959, p. 230-236.

**11548 Transactions of the 1959 International Symposium on Circuit and Information Theory.** Discusses the areas of optimum filter; coding; graph and matrix; switching; signal, noise and detection; and random, adaptive and unilateral systems. *IRE Transactions on Circuit Theory*, v. CT-6, Suppl., May 1959, 298 pp. (TK1 In6.6c Vis.)

**11549 Doppler Phenomena in Space Communications.** The Doppler phenomenon is studied under space-flight conditions. These conditions impose resistrictions and introduce influences which otherwise are of negligible importance. Examples of undesired effects of the Doppler shift in space communication and of applications for useful purposes are given. ***F. J. Tischer.*** *IRE Transactions on Communications Systems*, v. CS-7, no. 1, May 1959, p. 25-30. (TK1 In6.6cs Vis.)

**11550 Performance Equations for a "Stationary" Passive Satellite Relay (22,000-Mile Altitude) for Communication.** Performance equations are given for the use of a single fixed satellite used as a passive bounce point for almost hemispherical coverage of the earth for communication purposes. ***Morris Handelsman.*** *IRE Transactions on Communications Systems*, v. CS-7, no. 1, May 1959, p. 31-37. (TK1 In6.6cs Vis.)

**11551 Radio Link Communication Reliability. A Three-Part Design Problem.** The degree of reliability required for equipment used in a global communications system must be designed into the equipment from the inception of the original design specifications and implemented through all stages of development, procurement, production, and testing. ***Melvin W. Green.*** *IRE Transactions on Communications Systems*, v. CS-7, no. 1, May 1959, p. 47-52. (TK1 In6.6cs Vis.)

**11552 A Comparison of Thin Tape and Wire Windings for Lumped-Parameter, Wide-Band, High-Frequency Transformers.** The spiral-tape-winding transformer is compared with the wire-winding transformer with an electrostatic screen, and it is shown that the former has no advantage over the latter except (perhaps) at quite low impedance levels. It is shown that the most favorable turns ratio is unity and that the most favorable impedance levels are low ones. ***T. R. O'Meara.*** *IRE Transactions on Component Parts*, v. CP-6, no. 2, June 1959, p. 49-57. (TK1 In6.6cp Vis.)

**11553 Problems in Long-Term Component Reliability.** Attempt has been made to gather together in a systematic way the very scattered references to long-term deterioration problems affecting the choice of materials of which components are made. Component testing procedure is discussed and special features of individual components which affect long-term deterioration are mentioned. ***K. E. Latimer.*** *IRE Transactions on Component Parts*, v. CP-6, no. 2, Juno 1959, p. 62-81. (TK1 In6.6cp Vis.)

**11554 The Physics of the Solid-State Maser.** The article focuses attention on one particular device, the three-level solid-state maser and outlines the general theory of emission and radiation processes, particularly as they apply to the microwave spectrum. Well-known expressions are derived for the operating characteristics of a three-level maser, particular attention being given to the significance of the various factors involved and their relationship to easily measured quantities. ***D. J. Howarth.*** *IRE Transactions on Component Parts*, v. CP-6, no. 2, June 1959, p. 81-93. (TK1 In6.6cp Vis.)

**11555 Metal and Oxide Film Potentiometers.** Recent developments in resistors and potentiometers of the noble metal and metal oxide film types are described. Photographic methods of producing "meandered" resistance paths in the two types have been developed, as well as means of Rh reinforcing the track portions to improve the wear characteristics, and to reduce the contact resistance against the wiper. ***G. V. Planer.*** *IRE Transactions on Component Parts*, v. CP-6, no. 2, June 1959, p. 105-108. (TK1 In6.6cp Vis.)

**11556 Recent Developments in Fixed Resistors.** In most cases developments have been largely progressive improvements without fundamental changes in the component. Some of the more interesting of recently developed types are also considered, these being metal films and metal oxide films and combinations. ***R. H. W. Burkett.*** *IRE Transactions on Component Parts*, v. CP-6, no. 2, June 1959, p. 109-113. (TK1 In6.6cp Vis.)

**11557 Development of Plastic Dielectric Capacitors.** The salient characteristics of capacitors having dielectrics of polystyrene, polythene, polytetrafluorethylene, and polyethylene terephthalate are enumerated, and the current trends are indicated. ***J. H. Cozens.*** *IRE Transactions on Component Parts*, v. CP-6, no. 2, June 1959, p. 114-118. (TK1 In6.6cp Vis.)

**11558 Increased Reliability and Better Quality Control Through Mechanized Assembly and Test.** ***L. K. Lee and J. W. Buffington.*** *IRE Transactions on Production Techniques, PGPT-4*, June 1959, p. 22-27. (TK1 In6.6p Vis.)

**11559 Consideration of RF Parameters for PCM Telemetry Systems.** This paper considers selections of RF parameters for PCM telemetry systems. It points out that if these parameters are correctly chosen, the bandwidths and sensitivity of a PCM system may be made comparable with those of other existing telemetry systems. ***D. D. McRae.*** *IRE Transactions on Space Electronics and Telemetry*, v. SET-5, no. 2, June 1959, p. 61-65. (TK1 In6.6r Vis.)

**11560 A Super-Fast, Carrier Quieted Telemetry System for Missile Impact Instrumentation.** Because of the short transmission range expected during sled tests, reliable carrier quieting of the receiver is obtained with transmitters of power outputs under 100 mw. High speed of response is obtainable by the use of rapid on-off keying of the carrier and the use of receivers and pulse amplifiers of sufficient bandwidth. ***J. L. Wright and J. C. Ruscus.*** *IRE Transactions on Space Electronics and Telemetry*, v. SET-5, no. 2, June 1959, p. 76-81. (TK1 In6.6r Vis.)

**11561 Operational Characteristics of the TLM-18 Automatic Tracking Telemetry Antenna.** Present abilities of the antenna are discussed, and points are cited to show where these abilities exceed, in some aspects, requirements for missile tracking. It is shown that the location of the antenna and the type modulation of the missile can have adverse effects upon smooth operation. ***Frank S. Coxe.*** *IRE Transactions on Space Electronics and Telemetry*, v. SET-5, no. 2, June 1959, p. 87-91. (TK1 In6.6r Vis.)

**11562* Related Experiments With Sound Waves and Electromagnetic Waves.** Certain higher order modes of air-borne sound waves in tubes possess a transverse or polarized nature, and electromagnetic properties such as cutoff effects, polarization rotation, and circular polarization can be shown for these sound waves. Externally-guided sound waves, similar to radio waves guided by a dielectric rod, are also discussed. ***Winston E. Kock.*** *I.R.E. Proceedings*, v. 47, July 1959, p. 1192-1201.

**11563* Tunnel Diodes as High-Frequency Devices.** An interesting type of voltage-controlled negative resistance in heavily doped semiconductor junction diodes. The effect, dis-

covered and explained by Esaki, is due to quantum-mechanical tunneling of carriers through the junction. Experimental and theoretical results are given which show the diode has great promise for frequencies in the kilomegacycle region. ***H. S. Sommers, Jr.*** *I.R.E. Proceedings,* v. 47, July 1959, p. 1201-1206.

**11564* An Application of Piecewise Approximations to Reliability and Statistical Design.** If a random variable can be expressed as a weighted sum of other random variables having known distributions which can be approximated piecewise by, for example, polynomials, the distribution of the random variable can be obtained, relatively easily, by the use of the algorithm described in this paper. ***Harry J. Gray.*** *I.R.E. Proceedings,* v. 47, July 1959, p. 1226-1231.

**11565* Preliminary Results of the National Bureau of Standards Radio and Ionospheric Observations During the International Geophysical Year.** A review is given of the activities of the National Bureau of Standards during the International Geophysical Year. The equipment used on each project is described and preliminary results of the observations are given. The following areas of research are discussed: (1) World Warning Agency, (2) Ionospheric Vertical Sounding Stations, (3) VHF Propagation, (4) VHF Equatorial Forward Scatter, (5) Radio Noise Network, (6) Radio Satellite Observations, (7) Airglow Observations, and (8) World Data Center for Airglow and Ionosphere. ***David M. Gates.*** *Journal of Research, National Bureau of Standards,* v. 63D, no. 1, July-Aug. 1959, p. 1-14.

**11566* Climatology of Ground-Based Radio Ducts.** Maximum observed incidence of ducts was determined as 13% in the tropics, 10% in the arctic, and 5% in the temperate zone, by analysis of 3 to 5 years of radiosonde data for a tropical, temperate, and arctic location. Annual maximums are observed in the winter for the arctic, and summer for the tropics. The arctic ducts arise from ground-based temperature inversions with the ground temperature less than −25 C while the tropical ducts are observed to occur with slight temperature and humidity lapse when the surface temperature is 30 C and greater. ***Bradford R. Bean.*** *Journal of Research, National Bureau of Standards,* v. 63D, no. 1, July-Aug. 1959, p. 29-34.

**11567* Power Requirements and Choice of an Optimum Frequency for a Worldwide Standard-Frequency Broadcasting Station.** Calculations are presented for the expected transmission characteristics and atmospheric noise levels in the 8- to 100-kc band. When these are combined with carrier-to-noise requirements for a given precision of frequency comparison, it is indicated that a minimum radiated power in the order of 10 to 100 kw for frequencies in the vicinity of 20 kc will be required to provide worldwide coverage. ***A. D. Watt and R. W. Plush.*** *Journal of Research, National Bureau of Standards,* v. 63D, no. 1, July-Aug. 1959, p. 35-44.

**11568* Measurements of Phase Stability Over a Low-Level Tropospheric Path.** This paper describes an analysis of phase variations measured at 9,400 mc over a 9.4-mile path near Boulder, Colorado, during a 40-hour period in September, 1958. The power spectral density of these variations is shown to be approximately proportional to $f^{-2.5}$ over a wide range of frequencies throughout the period of recording. The long-term phase variations are closely correlated with atmospheric refractivity measurements made at the path terminals. ***M. C. Thompson, Jr. and H. B. Janes.*** *Journal of Research, National Bureau of Standards,* v. 63D, no. 1, July-Aug. 1959, p. 45-51.

**11569* System Loss in Radio Wave Propagation.** A summary is presented of the ways in which the concept of system loss and the closely related concepts of transmission loss, basic transmission loss, propagation loss, and path antenna gain may be used for precise, yet simple, descriptions of some of the characteristics of radio wave propagation which are important in the design of radio systems. A more general formula for the system loss is given which may be used for antennas with an arbitrarily small separation. Using this formula, it is shown that the system loss between small electric or magnetic dipoles separated by a distance $a < \lambda$ can be made arbitrarily small even though the individual antennas have large circuit losses. Formulas are developed for the percentage of time that a desired signal is free of interference, and these are used to demonstrate methods for the efficient use of the spectrum. An analysis is made of the variance of the path antenna gain in ionospheric scatter propagation. Methods are given for the calculation of the transmission loss for the ground wave and tropospheric scatter modes of propagation through a turbulent model atmosphere with an exponential gradient. ***Kenneth A. Norton.*** *Journal of Research, National Bureau of Standards,* v. 63D, no. 1, July-Aug. 1959, p. 53-73.

**11570* Mode Expansion in the Low-Frequency Range for Propagation Through a Curved Stratified Atmosphere.** ***H. Bremmer.*** *Journal of Research, National Bureau of Standards,* v. 63D, no. 1, July-Aug. 1959, p. 75-85.

**11571* Low-Frequency Propagation Paths in Arctic Areas.** Field intensities from transmitters located in the Labrador and Greenland areas were measured both on the surface of the earth and during several aircraft flights over this area. Under conditions where the initial portion of the propagation path is across icecap or permafrost, the attenuation observed is very great, and when the propagation path extends out over sea water, the field intensity recovery taking place after the coastline is crossed is very marked. Estimates of skywave field intensity appear to agree with the observed results, provided the radiated field pattern is suitably modified by the antenna cutback factor, which accounts for the presence of a finitely conducting curved earth. ***A. D. Watt, E. L. Maxwell, and E. H. Whelan.*** *Journal of Research, National Bureau of Standards,* v. 63D, no. 1, July-Aug. 1959, p. 99-112.

**11572 Filter Calculations Using the Template Method.** The template method of systematic calculation of the cutoff frequencies of a filter and stop resonance frequencies for given filter characteristics are first treated in principle. A new practical formulation of the template method is then proposed which satisfies very stringent requirements. Finally, it is shown how account is taken of the losses in inductors and capacitors and mismatch losses at the terminals of the filter, whereby the importance of manufacturing tolerances is mentioned. ***Torbern Laurent.*** *Kungliga Tekniska Högskolans Handlingar,* no. 135, 1959, 28 pp. (T4 K96t Vis.)

**11573 Magnetic Amplifier Engineering.** The book presents a consistent analytical method which can be applied to all types of magnetic amplifiers. ***George M. Attura.*** 220 pp. 1959. McGraw-Hill, New York. (TK2851 At87m)

**11574* Low Noise Antennas.** It has been shown that with the new low noise microwave amplifiers, the noise transduced by the antenna is a limiting factor, and that the absolute system sensitivity is approximately proportional to the antenna effective noise temperature. ***Robert C. Hansen.*** *Microwave Journal,* v. 2, June 1959, p 19-24.

**11575* Spin Waves.** ***P. E. Tannenwald.*** *Microwave Journal,* v. 2, July 1959, p. 25-28.

**11576* Modulator Techniques for Gridded Klystrons and Traveling Wave Tubes.** Summarizes properties of gridded klystrons and TWT's as load elements preliminary to a description of "floating-deck" circuits and their applications. ***Joseph P. Swanson.*** *Microwave Journal,* v. 2, July 1959, p. 29-33.

**11577* Graphical Analysis of Microwave Components. II.** This is the second of two articles on the analysis of microwave components by the Smith Diagram. In the last article, examples were chosen, centering around waveguide junctions. Numerous special cases were considered. One of special interest incorporated symmetry. In it were the principles of the familiar device known as the waveguide stub-tuner. The present article will be concerned mainly with filters, but it will include also a device that, in effect, enables us to reach inside an evacuated electronic device to perform experiments, and thus learn much about its rather complicated behavior. ***George C. Southworth.*** *Microwave Journal,* v. 2, July 1959, p. 33-39.

**11578* Graphical Analysis of Microwave Components. I.** Discusses waveguide junctions, types of junctions, junctions as reactors, waveguide stub tuners. ***George C. Southworth.*** *Microwave Journal,* v. 2, June 1959, p. 25-29.

**11579* Rapid Measurement of Microwave Cavity Parameters.** A measurement technique for the rapid determination of microwave cavity parameters is described. The technique is first evolved for the condition where the cavity under test terminates a transmission line. ***Richard J. Mohr.*** *Microwave Journal*, v. 2, June 1959, p. 30-32.

**11580 New Directions in Reliability Engineering.** Discusses the concept of (1) setting reliability requirements, (2) design analysis, (3) development of evaluation techniques, (4) quality control, (5) quality assurance, (6) specification engineering, (7) environmental evaluations, (8) failure analysis, and (9) data analysis and presentation. ***Kenneth E. Cochran.*** *Military Electronics*, v. 6, June 1959, p. 13-16.

**11581 "Build-Out" Corrects Waveforms.** Delay-equalizer units give engineers a highly flexible tool for solving network problems designing all types of communications systems. ***James L. Hollis.*** *Military Electronics*, v. 7, July 1959, p. 19 + 3 pages.

**11582 A Big Step in Digital Telemetry.** Space Electronics Corp.'s Digilock system offers advantages of digital techniques minus some of its disadvantages for missile system development. ***Hal Gettings.*** *Missiles and Rockets*, v. 5, no. 29, July 13, 1959, p. 37 + 2 pp.

**11583 Physical Problems of Thermoelectricity.** Efficiency of thermoelectric generators of electricity, refrigerators, and heaters; conditions for optimum figure-of-merit of thermoelements; establishment of optimum carrier concentration; scattering mechanisms of charge carriers. ***A. F. Joffe and L. S. Stil'bans.*** (Translated from the Russian by M. G. Priestley.) Paper from "Reports on Progress in Physics", v. XXII. p. 167-203, 1959. The Physical Society, London. (QC3 P56r Vis.)

**11584* Galvano- and Thermomagnetic Effects in α-$Ag_2Te$.** Nernst coefficient, magnetoresistance, and magnetothermoelectric power along with conductivity, Hall coefficient and thermoelectric power of α-$Ag_2Te$ are measured as functions of the e.m.f., E of the galvanic cell $Ag/AgI/Ag_2Te/Pt$. ***Shin-ya Miyatani and Isaaki Yokota.*** *Physical Society of Japan, Journal*, v. 14, June 1959, p. 750-754.

**11585 Proceedings of the Symposium on Electronic Waveguides, New York, N. Y., April 8, 9, 10, 1958.** v. VIII. 418 pp. 1958. Polytechnic Press of the Polytechnic Institute of Brooklyn, New York. (TK7872.W3 B7i.5)

**11586 Proceedings of the Symposium on Microminiaturization of Electronic Assemblies.** Techniques, semiconductors, components, circuits, missile systems, microelectronics in industry. ***Eleanor F. Horsey and Laurence D. Shergalis, editors.*** 278 pp. 1958. Hayden Book Company, New York. (TK7870 Sy68p)

**11587* Tropospheric Scattering of the Micro Radio Wave Around 2000 M Hz.** Describes a 1 KW transmitter-receiver antenna system using two parabolic reflectors 10 meters in diameter mounted on a 45 meter mast. (*In German.*) Übereichweiten-Richtfunk im Dezimeterwellenbereich um 2000 MHz. ***Max Jung and Norbert Langer.*** *Siemens Zeitschrift*, v. 33, no. 5, May 1959, p. 305-310.

**11588* A Proper Perspective in Printed Circuits.** A survey of the developments in the field of printed circuits is presented to provide the engineer with a sound basis for understanding this production technique. Design and manufacturing practices are described. ***Herbert R. Reiss, Hillard B. Swede, and John W. Trinkaus.*** *Sperry Engineering Review*, v. 12, no. 2, June 1959, p. 34-40.

**11589 The McGill Symposium on Microwave Optics. I. Microwave Optics.** A collection of 61 papers. ***B. S. Karasik, editor.*** *U. S. Air Force, Cambridge Research Center, AFCRC-TR*-59-118(I), Apr. 1959. 130 pp. (TK7800 Un3.12b Contin.)

**11590 The McGill Symposium on Microwave Optics. II. Diffraction and Scattering.** A collection of 61 papers. ***B. S. Karasik, editor.*** *U. S. Air Force, Cambridge Research Center AFCRC-TR*-59-118(II), Apr. 1959, 369 pp. (TK7800 Un3.12b Contin.)

**11591* Radiation Recombination in Semiconductors.** Discussed are the theory of direct recombination of electrons and of holes with the emission of photon, experimental methods of stimulation and investigation of spectra of recombination radiation and other. (*In Russian.*) Izluchatel'naia rekombinatsiia v poluprovodnikakh. ***V. S. Vavilov.*** *Uspekhi Fizicheskikh Nauk*, v. 68, no. 2, June 1959, p. 247-260.

**11592* Development of Magnetrons for Millimeter Wavelengths.** This paper deals with the method of fabrication and results of experiments conducted on a Rising Sun Type 40 split anode magnetrons, at wavelengths of 5.7 and 7.0 millimeters. The anode block is machinable with usual cutting machines down to a slot width of about 0.2 mm by the use of specially designed jigs and tools. Decrease of anode diameter and slot width below 5 mm and 0.2 mm, respectively, accompanies increased difficulty in machining so that decreased precision is inherent. (*In French.*) Réalisation de magnétrons millimétriques. ***Saburo Aoi, Sumio Nakajima, Sanai Mito, and Kozaburo Baba.*** *Vide*, v. 14, no. 79, Jan.-Feb. 1959, p. 7-18.

***See also:*** **11518** (electroforming waveguides); **11667** atmospheric effects on radar); **11956** (structure of InAs); **12167** (thermoelectricity); **12300** (cleaning vacuum tube components).

## ENGINEERING ECONOMICS

**11593*How to Measure Profit Contribution.** The share of production principle—measuring the economic productivity of any factor of production, guiding redetermination of basic wages and salaries, and paying incentives (when desired) for gains as they are actually realized—provides a new management tool especially adapted to these times. ***Allen W. Rucker.*** *American Business*, v. 29, July 1959, p. 7 + 5 pages.

**11594 The Impact of Value Analysis.** A broad description of the value analysis program at General Electric, including a detailed training program for value analysts and specific examples of savings. ***Tom Johnson.*** *American Machinist*, v. 103, July 13, 1959, p. 117-132.

**11595* Manufacturing Engineering and Machine Procurement.** Proper climate must be established to make the techniques of manufacturing engineering effective. Projects must be determined with consideration of underlying general areas for improvement which can be identified by use of various management tools. Each project can then be completed as a coordinated effort under the manufacturing engineer from investigation of processes and vendors to equipment acceptance. ***Armin C. Frank, Jr.*** *Automation*, v. 6, July 1959, p. 44-52.

**11596* Government Finances in Economic Perspective.** ***John C. Swartley.*** *Bell Telephone Magazine*, v. 38, no. 2, Summer 1959, p. 25-32.

**11597 Seasoning B-Schools With a Dash of Liberal Arts.** What six deans think the business school should be. *Business Week*, no. 1559, July 18, 1959, p. 112 + 4 pages.

**11598 In Business Education, the Game's the Thing.** The trend is toward games simulating business conditions as a training aid. *Business Week*, no. 1560, July 25, 1959, p. 56 + 4 pages.

**11599 More Light on Predicting Your Maintenance Costs.** *Chemical Engineering*, v. 66, July 13, 1959, p. 172 + 3 pages.

**11600* The Chemical Engineer Applies Market Research.** An all-day symposium on chemical market research was held at the 39th National Meeting of the A.I.Ch.E. at Atlantic City, New Jersey, on March 16, 1959. The morning session dealt with the functions and uses of market research in the chemical company. ***Rudolph Cziner.*** *Chemical Engineering Progress*, v. 55, July 1959, p. 38-40.

**11601* Sales Forecasting.** The general aim of either sales or economic forecasting is to provide management with reliable advance information on future business conditions. ***Richard***

***Berger.*** *Chemical Engineering Progress*, v. 55, July 1959, p. 40-42.

**11602* Correlation Analysis.** Correlation analysis in forecasting the demand or supply for a product involves determining and measuring its relationship to a certain economic or other factor, or group of factors. ***Gerald J. Bayern and Robert I. Chien.*** *Chemical Engineering Progress*, v. 55, July 1959, p. 42-45.

**11603* Input - Output.** The input-output technique is graphically represented by a square table, having complementary rows and columns of figures. Each row records the receipt by, or demand from, other sectors of industry. Each column shows the disbursements of industry to other sectors. Thus, the rows represent the outputs to the several sectors, while the column figures show the inputs from various sectors, or the inputs required to produce the output of the sector. ***Robert E. Johnson.*** *Chemical Engineering Progress*, v. 55, July 1959, p. 46-48.

**11604 Is Cobalt in Short Supply?** Cobalt is not in danger of short supply. At the present time, production well exceeds consumption. The "Cobalt Information Center" has sponsored a research program to develop desirable and unknown properties of Co and to investigate possible new uses. ***F. R. Morral.*** *Cobalt*, no. 3, June 1959, p. 16.

**11605 Economic Analysis of Fairbanks and Contiguous Area, Alaska.** This summary analysis of the economic development of Fairbanks and contiguous area of Alaska was prepared over a period of 18 months for the Golden Valley Electric Association, Inc. of Fairbanks. Sections individually paged. Jan. 1959. North Pacific Consultants, Portland, Oregon. (HC108.F1 N81e Over.)

**11606 A Cash-Flow Definition of Working Capital.** Accounting concepts are not applicable for investment evaluation. ***James B. Weaver and Frank S. Lyndall.*** *Industrial and Engineering Chemistry*, v. 51, Aug. 1959, p. 49A-51A.

**11607* What Should Trade Missions Mean to You?** Describes the U. S. Commerce Department's trade missions, their significance in promoting international trade and world peace. ***Fred Wittner.*** *Industrial Marketing*, v. 44, July 1959, pt. 1, p. 44-48.

**11608 Metal Products From Holland.** This new edition of the "Metal Products from Holland", first published in 1953, aims to give a helping hand to purchasers. The turnover to foreign countries of the Dutch metallurgic industry amounts to more than 35% of the sales of the whole Dutch industry. Dutch metal products include complete installations for factories, ships, Diesel engines, and harbor installations, coffee mills, precision balances, steel furniture. In this second edition, many improvements have been made and new products have been added to the list. The index of products is in Dutch, English, French, and Spanish. (*In Dutch.*) Produktenboek. 2nd Ed. 768 pp. 1958. Vereniging van Metaal-Industrieen. The Hague, The Netherlands. (T12 N3m)

**11609* An Operations-Research Evaluation Technique of the Use of Sales-Research Information.** A working hypothesis about the process by which the raw data of a sales organization are used in decision-making has been found necessary in the on-going inquiry into the optimum structure of information for a multi-plant, multi-product organization. The not-so-direct paths, from raw data to research information, from research information to decision-making, and from decision-making to change in sales make the model more difficult to define functionally and to determine empirically. ***George K. Chacko.*** *Operations Research*, v. 7, no. 3, May-June 1959, p. 313-321.

**11610* Locating the Market for Plastics Products.** How available statistics can be used to locate and identify plants using plastics end-products, and the volumes of the specific application fields involved. ***Jay M. Gould.*** *Plastics Technology*, v. 5, July 1959, p. 43-48.

**11611 A Dollars-and-Cents Evaluation of New Products.** Four factors to evaluate: (1) Average development cost/year, (2) Years of development time, (3) Average profit/year of product life, (4) Average product market life. ***Sidney Sobelman.*** *Product Engineering*, v. 30, no. 26, June 29, 1959, p. 21-23.

**11612 Soviet Industrial Growth.** Estimates of it face difficulties, but the "best" Western guess finds Soviet claims much exaggerated. ***G. Warren Nutter.*** *Science*, v. 130, July 31, 1959, p. 252-255.

**11613 Strategy and Market Structure. Competition, Oligopoly, and the Theory of Games.** Offers a unified approach to the various theories of competition and markets, using the techniques of game theory. Emphasis is placed on the general properties of strategic interdependence in economic markets. A step in the development of a dynamic theory of markets, the book develops a theory which is general and abstract, yet is directly amenable to use in empirical work on market forms. ***Martin Shubik.*** 387 pp. 1959. John Wiley & Sons, Inc., New York. (HB771 Sh91s)

***See also:*** **11251** (economics of saline water conversion); **11253** (world fertilizer market); **11257** (chemical process economics); **11263** (economics of two-stage cat cracking); **11837** (cost of materials for stainless steels).

## FLUID MECHANICS

**11614 Advanced Mechanics of Fluids.** Research in fluid motion; fundamental concepts and equations; laminar motion; boundary layers; and free-turbulence shear flow. ***D. W. Appel, et al.*** 444 pp. 1959. John Wiley & Sons, Inc., New York. (QA901 R76a)

**11615* Joint Industry Conference. Hydraulic Standards for Industrial Equipment.** Revised and adopted at the April 15-17, 1959, Conference. *Applied Hydraulics & Pneumatics*, v. 12, July 1959, p. JIC 1-JIC 30.

**11616 Free Surface Oscillations in a Rotating Liquid.** The disturbed motion of a liquid having a free surface in a vertical, rotating, circular cylinder and an equilibrium distribution of velocity corresponding to rigid body rotation is studied in linear approximation. It is shown that a vertical gradient of velocity necessarily generates vorticity, whence the disturbed motion cannot remain irrotational. ***John W. Miles.*** *Physics of Fluids*, v. 2, no. 3, May-June 1959, p. 297-305.

**11617 Sound, Fluid Flow and Heat Transfer.** The little-understood but important effects of resonance on heat transfer are studied with special acoustical apparatus. Known as "skreech", the noise a rocket or jet engine emits when it goes into resonance is accompanied by a great increase in the heat transfer rate from the hot combustion gases to the engine walls. ***Thomas W. Jackson and Jack M. Spurlock.*** *Research Engineer*, v. 14, no. 3, June 1959, p. 4-9.

**11618 An Example of Minimum Energy Dissipation in Viscous Flow.** An approximate theory is developed to describe the behavior of a heavy ball passing slowly down a vertical tube having a diameter only slightly exceeding the diameter of the ball, and filled with a viscous fluid. ***D. G. Christopherson and D. Dowson.*** *Royal Society, Proceedings*, v. 251, ser. A, June 23, 1959, p. 550-564.

**11619 A New Apparatus for Liquid Phase Thermal Diffusion.** Deals with the so-called forgotten effect which refers to the effect on the column performance of that part of the density gradient due solely to the concentration gradient in the liquid. ***Edward Von Halle.*** U. S. *Atomic Energy Commission*, K-1420, June 24, 1959, 353 pp. (UF767 Un3.1k Contin.)

## FOOD TECHNOLOGY

**11620* Concentration and Drying Plant Operates Without Steam.** 180,000 pounds of skim milk a day is pasteurized at 162 F, concentrated at 95 F, preheated to 162 F, and spray dried, with excess distilled water condensate at 200 F for plant

use. ***Howard P. Milleville, editor.*** *Food Processing*, v. 20, Aug. 1959, p. 28-31.

**11621* Improving Quality of Extruded Marshmallows.** Extra-high-strength gelatin is key. ***William I. Gorfinkle.*** *Food Processing*, v. 20, Aug. 1959, p. 39 + 2 pages.

**11622* Meat Tenderization. III. Hydrolysis of Actomyosin, Actin and Collagen by Papain.** Compared to other proteolytic enzymes, papain is more active in hydrolyzing actomyosin. Papain catalyzed actomyosin hydrolysis had a low activation energy of 6.5 kg. cal. per mole and proceeded faster than actin or collagen hydrolysis. ***C. C. Tsen and A. L. Tappel.*** *Food Research*, v. 24, no. 4, July-Aug. 1959, p. 362-364.

**11623* Rate of Mineral Removal From Milk by Ion Exchange.** In a mixed bed of three parts of weakly basic anion exchanger and two parts of weakly acidic cation exchanger, Mg, Ca, K, P and Na ions were removed at rates decreasing in that order. In completely decalcified milk, K, Na and phosphate ions remained in 25%, 70%, and 40% of initial concentrations, respectively. Magnesium was completely removed when 70% of the weight of Ca was removed. ***S. J. Bishov, A. S. Henick, and J. H. Mitchell, Jr.*** *Food Research*, v. 24, no. 4, July-Aug. 1959, p. 428-433.

**11624* Effect of Method of Extraction of Juice on the Development of Bitterness in Preserved Orange Juice.** ***G. S. Siddappa and B. S. Bhatia.*** *Food Technology*, v. 13, July 1959, p. 349-351.

**11625* The Protection of Some Baked Products Against Moulds by Chemical and Irradiation Techniques.** ***D. W. E. Axford and F. J. H. Ottaway.*** *Journal of Biochemical and Microbiological Technology and Engineering*, v. 1, no. 1, Feb. 1959, p. 99-113.

**11626* Ghana: A Challenge to Nutritionists.** ***Jean Mayer.*** *Nutrition Reviews*, v. 17, July 1959, p. 193-196.

## FUELS AND COMBUSTION

**11627 Aluminized Fuels Used in New Missiles.** Encapsulated Al particles guard against premature reaction increase rocket shelf life. ***Michael Yaffee.*** *Aviation Week*, v. 71, Aug. 3, 1959, p. 26.

**11628* Radiation From Explosion Flames of Carbon Monoxide.** Shows that chemiluminescence occurs almost entirely before maximum pressure is developed. Details of the elaborate techniques evolved are given; the new spherical explosion vessel is described, and necessary computational procedures indicated. ***A. Smeeton Leah and H. Watson.*** *Combustion and Flame*, v. 3, no. 2, June 1959, p. 169-186.

**11629* Comparative Study of Flame Propagation in Compounds Containing Nitrogen Oxides.** Flame propagation velocities and temperatures have been measured in methyl nitrite, nitromethane, and methane-nitrogen dioxide mixtures with oxygen. ***S. de Jaegere and A. van Tiggelen.*** *Combustion and Flame*, v. 3, no. 2, June 1959, p. 187-200.

**11630* Theory and Manufacture of Shaped Coke.** New views about theory of carbonization. In the USSR a new technology for production of metallurgical coke has developed. (*In Czech.*) Theorie a výroba formovaného koksu. ***Bohumil Šplichal.*** *Hutnické Listy*, v. 14, no. 6, June 1959, p. 473-476.

**11631 Combustion Investigation in the Hypersonic Shock Tunnel Driver Section.** An investigation was made of the combustion of stoichiometric mixtures of H and O with a varying percent of He in the constant volume driver section for a hypersonic shock tunnel. The pressure was measured as a function of time for a number of initial pressures, mixture ratios, and multiple sparks for ignition. ***H. T. Nagamatsu and E. D. Martin.*** *Journal of Applied Physics*, v. 30, July 1959, p. 1018-1021.

**11632 A Theoretical Treatment of Combustion in a Spherical Underwater Gas Bubble.** The combustion equations and equation of motion of surface of bubble are formulated on assumptions that the gases are ignited at their center and that the flame front travels outward in the form of a sphere. The equations are integrated to yield gas pressure and bubble radius as functions of time. ***D. A. Senior.*** *Royal Society, Proceedings*, v. 251, ser. A, June 23, 1959, p. 493-503.

**11633 Seventh Symposium (International) on Combustion, at London and Oxford, Aug. 28-Sept. 3, 1958.** Only 124 of the roughly 200 papers submitted were chosen on an extremely selective basis. The papers have been grouped by subject, including the following categories: mechanisms of combustion reactions, spectroscopy and ionization in flames, structure and propagation of flames, turbulence in flames, detonation and its initiation, and special fuels. 959 pp. 1959. Butterworths Scientific Publications, London. (QD516 Sy68)

**11634 The Effect of Pressure on the Burning Velocity of Various Gas Mixtures (Measured by the Soap Bubble Method).** Results showed that mixtures whose adiabatic flame temperatures increase appreciably with pressure also had burning velocities which increase with pressure. ***William A. Strauss and Rudolph Edse.*** *U. S. Air Force, Wright Air Development Center, WADC Technical Report* 58-464, Dec. 1958, 38 pp. (TL507 Un3.18w Vis.)

**11635 Agglomeration Studies in the Low-Pressure Hydrogenation of Coal in a Fluidized Bed.** Agglomeration may be reduced or eliminated by employing a comparatively slow heating rate, by pretreatment at 400 C with or without H, by impregnating with alkali carbonate or ammonium molybdate, or by dilution with material such as char. ***Walter Kawa, et al.*** *U. S. Bureau of Mines, Bulletin* 579, 1959, 11 pages. (TN21 Un3b Vis.)

***See also:*** **11239** (carburation of fuel oil).

## GEOLOGY, GEOPHYSICS, MINERALOGY, AND MINING ENGINEERING

**11636* On the Anomaly of Electrotellurium Field in the Region of Ushkar Islands of Lake Baikal.** A study of distribution of currents as a function of configuration of shores and of depth of the Baikal Lake. Abnormally large amplitude of variations and short period variations of the "pulsation continuous" and "pulsation trains" types were found. (*In Russian.*) Ob anomalii elektrotellurichеskogo polia v raĭone ushkan'ikh ostrovov (oz. Baĭkal). ***P. A. Vinogradov.*** *Akademiia Nauk SSSR, Doklady*, v. 126, no. 3, May 21, 1959, p. 561-564.

**11637* Evaluation of an Objective Method for the Prediction of Central Pressures of North Pacific Cyclones.** The U. S. Navy's Project-AROWA method of forecasting 24-hr deepening of North Atlantic surface cyclones is applied, with modifications, to the North Pacific for both winter and summer. ***Edward L. Snopkowski and Paul R. Welch.*** *American Meteorological Society, Bulletin*, v. 40, July 1959, p. 336-339.

**11638* Duration of Tornadoes.** Estimates average path lengths and durations of individual tornadoes. ***Louis J. Battan.*** *American Meteorological Society, Bulletin*, v. 40, July 1959, p. 340-342.

**11639 Applied Petroleum Reservoir Engineering.** Applies engineering data to the calculation of reservoir contents and recovery potentials and to the analysis and prediction of reservoir performance under a variety of production methods. ***B. C. Craft and M. F. Hawkins.*** 437 pp. 1959. Prentice-Hall, Inc., Englewood Cliffs, N. J. (TN870 C84a)

**11640* Theory of the Mode Spectra of Cylindrical Waveguides Containing Gyromagnetic Media.** ***R. A. Waldron.*** *British Institution of Radio Engineers, Journal*, v. 19, June 1959, p. 347-356.

**11641* Monazite as an Ore Mineral in Elliot Lake Uranium Ores.** Most of the monazite in ores is of abnormally high U content. ***S. M. Roscoe.*** *Canadian Mining Journal*, v. 80, July 1959, p. 65-66.

**11642 Conference on Physical and Chemical Properties of Sea Water, Easton, Maryland, September 4-5, 1958.** Individual papers on properties, currents, methods, and biological considerations of sea water. 202 pp. 1959. National Academy of Sciences—National Research Council, Washington, D. C. (GC101 C76p)

**11643* Percussion Tool Lengthens Life, Speeds Penetration Rate.** This new air or gas rotary percussion drilling tool achieves both faster penetration rates and longer bit life than conventional oil and gas drilling methods. Penetration rates range from two to five times the rates established by conventional rotary air drilling, and with up to four times longer bit life. *Drilling*, v. 20, June 1959, p. 90.

**11644* Effects of Weight and Speed on Penetration Rate.** A controlled weight-speed program in which more information is available than is now shown on a daily drilling report would provide a basis to work from and will, as tests have shown, promote more efficient well drilling practices. ***Jack Knowlton.*** *Drilling Contractor*, v. 15, no. 4, June-July 1959, p. 46-48.

**11645* An Analysis of Air Drilling.** Indicates that presently available air drilling techniques should allow greater geographic extension of the method and a re-appraisal of areas where earlier attempts with air were unsatisfactory. It is possible that some interval in every hole drilled can profitably utilize the penetration and formation evaluation advantages of air. ***Gordon Jackson.*** *Drilling Contractor*, v. 15, no. 4, June-July 1959, p. 57 + 2 pages.

**11646* Selenium in Some Canadian Sulfides.** Richest Se concentrations are found in some of the Precambrian nonnickeliferous Cu ores. In general, no order of preference is indicated by the individual sulfides. Selenium is somewhat enriched in lower temperature pyrite, a distinct enrichment is noted in the upper levels of more deeply explored deposits. ***J. E. Hawley and Ian Nichol.*** *Economic Geology*, v. 54, no. 4, June-July 1959, p. 608-628.

**11647 Janol Method—A New Mining Concept.** Blasting with shotholes placed parallel to the face intended to be broken out, i.e., at right angles to the line of advance. Holes placed in this manner produce the best blasting effect. ***Ingvar Janelid and Gunnar Olsson.*** *Engineering and Mining Journal*, v. 160, July 1959, p. 86-90.

**11648* A Contribution to the Geochemistry of Reservoir Formations: The Lower Frasnian of the Volga-Urals. I.** ***N. M. Strakhov, K. F. Rodionova, and E. S. Zalmanzon.*** *International Geology Review*, v. 1, May 1959, p. 1-23.

**11649* Preliminary Data on the Geology of the Antarctic Coast Between Longitudes 89° and 107° E.** Nunataks, oases, and other bedrock outcrops consist of gneiss, granite, basic dikes, and leucite basalt. Faulting apparently determined in part the morphological character of the continent and of adjacent ocean bottoms. ***O. S. Vyalov.*** *International Geology Review*, v. 1, May 1959, p. 24-28.

**11650* Association of Ore Bodies in Granitoids of the Caucasus and the Genesis of These Rocks.** Volcanic, sedimentary, and effusive rocks; genesis of granitoids and their association with ore formation. ***G. M. Zaridze.*** *International Geology Review*, v. 1, May 1959, p. 29-40.

**11651* Cosmic-Ray Intensities and Liquid-Water Content in the Atmosphere.** ***H. Arakawa.*** *Journal of Geophysical Research*, v. 64, no. 6, June 1959, p. 625-629.

**11652* Beryllium.** Summary of the occurrence, output and reserves of beryl, together with notes on metallurgical processes for the production of the metal. ***T. H. H. Skeet.*** *Mine & Quarry Engineering*, v. 25, June 1959, p. 263-269.

**11653* Exploration of Large Areas.** Small scale tectonic maps, selection of attractive regions, large scale map studies of attractive regions, geochemical exploration, and interpretation of results. ***S. E. Jerome.*** *Mining Congress Journal*, v. 45, July 1959, p. 37-40.

**11654 X-Ray Mineral Analysis Techniques.** Survey of applications of X-ray fluorescence analysis techniques to problems of exploration and mining. ***Ralph E. Wood.*** *Mining Engineering*, v. 11, June 1959, p. 602-604.

**11655* Atomic Blasting for Mining.** Mining is practical, safe, and low-cost, reports this panel of experts at the second symposium on Industrial Uses of Nuclear Explosives. *Mining World*, v. 21, no. 8, July 1959, p. 31-33.

**11656* How Miners Solve Tough Problems at Ambrosia Lake's Wet Mines.** ***George O. Argall, Jr.*** *Mining World*, v. 21, no. 8, July 1959, p. 34 + 5 pages.

**11657* On Some Offshore Seismic Refraction Profiles in the Cook Strait, Tasman Bay, and Golden Bay Areas of New Zealand.** ***C. B. Officer.*** *New Zealand Journal of Geology and Geophysics*, v. 2, no. 2, May 1959, p. 350-354.

**11658* A Geological Appraisal of Present and Future Exploration Techniques on Salt Domes of the Gulf Region of the U. S.** Deals primarily with the five salt-dome basins, covering present and future exploration techniques. ***M. T. Halbouty and G. C. Hardin, Jr.*** *Oil and Gas Journal*, v. 57, no. 24, June 8, 1959, p. 134-137.

**11659* What's the Score on Neutron Logging?** The story on a new development—the accelerator neutron source—and of other advances in past four or five years. ***A. H. Youmans and C. W. Zimmerman.*** *Oil and Gas Journal*, v. 57, no. 24, June 8, 1959, p. 139-141.

**11660* New Perforating Method Developed.** Hydra-Perf uses a directed stream of abrasive containing fluid to cut holes through casing, cement, and pay formation. *Oil and Gas Journal*, v. 57, no. 25, June 15, 1959, p. 68-70.

**11661* Diatomaceous Earth Cures Lost Circulation in Cementing Casing.** Lightweight slurries maintain circulation while casing is being cemented; frequently make possible cementing casing in a single stage. ***A. J. Willis and R. A. Wynne.*** *Oil and Gas Journal*, v. 57, no. 32, Aug. 3, 1959, p. 78-84.

**11662 Oil Well Drilling Technology.** ***Arthur W. McCray and Frank W. Cole.*** 492 pp. 1959. University of Oklahoma Press, Norman, Oklahoma. (TN871.2 M130)

**11663 A Practical Approach to Choosing a Fracturing Fluid.** Choice of fracturing fluid can determine extent of formation fracture based on "leak off" control as defined by Howard and Fast. ***V. C. White.*** *Petroleum Engineer*, v. 31, June 1959, p. B56 + 1 page.

**11664* Increasing: Palynology's Role in Oil.** Pollen fossil studies lead to identification of geological formations. *Petroleum Week*, v. 8, no. 24, June 12, 1959, p. 35.

**11665* Seismic Technique Aids Quarry Operations.** Subsurface strata studies indicate most economical methods for overburden removal. *Pit and Quarry*, v. 52, no. 1, July 1959, p. 86-88.

**11666* Meteorology—Newest Region of Exploration.** The most liked investigation concerns the stratosphere. The result of climate modification will be predictable when the large-scale circulations of the atmosphere are understood and can be predicted. ***Elmer Robinson.*** *SRI Journal*, v. 3, no. 2, 1959, p. 37-40.

**11667* Radar—New Weather Eye.** Discusses effects of the atmosphere on radar beams, detection by radar beam reflection, problems of refraction, detection by radar beam attenuation, natural radiations at radar frequencies, and the future of radar meteorology. ***Myron G. H. Ligda.*** *SRI Journal*, v. 3, no. 2, 1959, p. 49-55.

**11668 Artificial Satellites and the Earth's Atmosphere.** In the auroral zones the upper atmosphere is much warmer than it is over the equator. Satellite data attribute this effect to solar particles trapped in the earth's great radiation belts. ***Robert Jastrow.*** *Scientific American*, v. 201, no. 2, Aug. 1959, p. 37-43.

**11669 Ocean Waves.** A review of how the waves are generated and propagated. ***Williard Bascom.*** *Scientific American*, v. 201, no. 2, Aug. 1959, p. 74-84.

**11670* On the Formation of Oil and Gas Pools.** Historical survey of the Russian investigations of oil and gas pool formation since 1837: the stratigraphic type (1910), the anticlinal theory, the hydronamic (1947) and gas dynamic factors involved (1954), the formation structures (1955), the differentiated trapping theory. (*In Russian.*) O formirovanii zalezheĭ nefti i gaza. ***S. F. Fedorov.*** *Sovetskaia Geologiia*, v. 2, no. 4, Apr. 1959, p. 3-20.

**11671 Subsurface Motion From a Confined Underground Detonation. I.** ***William R. Perret.*** *U. S. Atomic Energy Commission, ITR*-1529, Nov. 25, 1958, 65 pp. (UF767 Un3.1it Contin.)

**11672 Analyses of Some Crude Oils From Alaska.** Contains Bureau of Mines routine crude-oil analyses of 20 samples from 5 areas on the arctic slope of Alaska. The analyses show that the oils vary greatly in physical characteristics and chemical composition. ***C. M. McKinney, E. L. Garton, and F. G. Schwartz.*** *U. S. Bureau of Mines Report of Investigations* 5447, 1959, 29 pp. (TN21 Un3r Vis.)

**11673 Here's How to Improve Your Gas Lift Installations. I. Pressure at Depth Determinations.** Demonstrates problem solution with tables. ***H. W. Winkler.*** *World Oil*, v. 149, Aug. 1959, p. 63-67.

***See also:*** **11184** (sounding rockets).

## GRAPHIC ARTS

**11674* Evaluating the Du Pont Photopolymer Plate.** *Graphic Arts Monthly*, v. 31, July 1959, p. 14 + 2 pages.

**11675* Better Halftones With the Magenta Contact Screen.** ***Charles Roeder.*** *Graphic Arts Monthly*, v. 31, July 1959, p. 66 + 5 pages.

**11676 Guide to Microreproduction Equipment.** ***Hubbard W. Ballou, editor.*** 438 pp. 1959. National Microfilm Association, Annapolis, Maryland. (Z265 N21g)

**11677* Photogrammetry Aids the Engineer.** New equipment and new methods have expanded the use of photogrammetric techniques; the future of "measurements from photographs" appears unlimited. ***A. O. Quinn.*** *Photogrammetric Engineering*, v. 25, no. 3, June 1959, p. 439-442.

**11678* Large-Field Photographic Astrometry.** Reviews development of large-field astrographs, engines for measurement of plates, and reduction of measurements. ***S. Vasilevskis.*** *Photogrammetric Engineering*, v. 25, no. 3, June 1959, p. 461-468.

**11679 Progress in Photography 1955-1958.** Includes Russian work on the theory of photographic emulsions. ***D. A. Spencer, editor.*** v. 3. 162 pp. 1959. MacMillan, New York. (TR15 P94 Vis.)

**11680* Application of a Liquid Layer on Negative Films to Eliminate Surface Defects in Optical Printing.** ***Raymond H. DeMoulin, Philip A. Ripson, Jr., and Stanley L. Scudder.*** *Society of Motion Picture and Television Engineers, Journal*, v. 68, June 1959, p. 415-416.

**11681* Color Exposure for High-Speed Photography of Some Events Requiring Artificial Illumination.** An economical multiple-source illumination system which provides sufficient illumination to produce color photographs at speeds up to 4000 pictures/sec. ***K. H. Lohse.*** *Society of Motion Picture and Television Engineers, Journal*, v. 68, June 1959, p. 417-422.

***See also:*** **11300** (Ag in photographic papers).

## HEAT POWER

**11682* How Allison Designed the Model 250 Engine.** Selection of parameters; free turbine; axial-centrifugal compressor; matching of components; control; mechanical configuration. ***R. S. Hall.*** *SAE Journal*, v. 67, July 1959, p. 54-56.

**11683* Improving Jet Engine Reliability.** Creep and stress rupture; turbine bucket life; mechanical fatigue; remedial measures; compressor blade vibration; thermal distortion and thermal fatigue; thermal stress fatigue on start. ***S. S. Manson, G. M. Ault, and B. Pinkel.*** *SAE Journal*, v. 67, July 1959, p. 57-61.

**11684 Turbine Cooling.** Of interest for certain applications to permit operation of gas-turbine engines above uncooled temperatures. Progress is reported on developments since 1952. ***Jack B. Esgar.*** *ASME, Transactions, Series A, Journal of Engineering for Power*, v. 81, no. 3, July 1959, p. 226-233.

**11685 Compound Piston-and-Turbine Engines.** Reports progress in the development of some of the more notable engines. ***A. L. London.*** *ASME, Transactions, Series A, Journal of Engineering for Power*, v. 81, no. 3, July 1959, p. 259-264.

**11686* Rockets for Manned-Flight.** Throttlable, 6000-lb. thrust units use $H_2O_2$/JP-4, designed for thrust augmentation in Navy fighters, may provide design seeds for larger rockets. *Aircraft and Missiles Manufacturing*, v. 2, Aug. 1959, p. 18-20.

**11687* Clean Air Cuts Engine Wear.** Considers damage done by dust-laden air; efficiency of modern air cleaners. *Diesel Power*, v. 37, July 1959, p. 46-48.

**11688* 300 HP Gas Turbine Weighs 650 Pounds.** Describes the Ford 704 gas turbine. *Drilling*, v. 20, June 1959, p. 127.

**11689 Improved Hot-Gas Engine, Using a Rhombic Drive Mechanism.** A new design of drive mechanism to the hot-gas engine. Permits Philips to drop their idea of using one piston to perform both power and gas-transfer functions and to return to the thermodynamically more efficient system of separate power and transfer pistons. ***R. J. Meijer.*** *Engineers' Digest*, v. 20, June 1959, p. 247 + 5 pages.

**11690 Heat Transfer and Fluid Mechanics Institute, 1959. Preprints of Papers.** Rarefied gas flows; magnetohydrodynamics, fluid mechanics and heat transfer; and ablation, mass transfer, and separation. 243 pp. 1959. Stanford University Press, Stanford, Calif. (QC320 H35p Vis.)

**11691* Combustion Studies in a Transpiration-Cooled Gas-Turbine Combustion Chamber.** ***B. V. Poulston.*** *Institute of Fuel, Journal*, v. 32, June 1959, p. 279-287.

**11692 Jet Propulsion Engines. v. XII. High Speed Aerodynamics and Jet Propulsion.** Air flow jet engines; general formulas; engine performance, control, and installation; thrust augmentation; design of rocket motors; and development trends. ***O. E. Lancaster, editor.*** 799 pp. 1959. Princeton University Press, Princeton, New Jersey. (TL709 H53)

**11693 Prospects for Thermoelectricity.** A research program to include high-temperature materials, liquids, films, behavior of materials under severe environments, design and fabrication principles of hardware, performance characteristics, and physical-chemical phenomena. ***Hal Gettings.*** *Missiles and Rockets*, v. 5, no. 26, June 22, 1959, p. 29-31.

**11694* Don't Waste That Gas-Turbine Heat. It Can Be Profitably Recovered.** Ability to provide large quantities of highly preheated air is the objective. ***Ivan G. Rice.*** *Oil and Gas Journal*, v. 57, no. 27, June 29, 1959, p. 66-70.

**11695* Versatility—The Turbine's Big Feature.** Reviews mechanics of turbine action. ***B. G. A. Skrotzki.*** *Power*, v. 103, Aug. 1959, p. 136 + 3 pages.

**11696* Thrust Magnitude of Solid-Propellant Engines Can Be Controlled.** Thrust magnitude variation controlled by variable orifice or variable-nozzle throat systems. The greatest thrust variation in solid-propellant engines is caused by grain temperature variation. There is a 25-30% increase for each 100 F increase. ***J. S. Gates and S. L. Pinto.*** *SAE Journal*, v. 67, July 1959, p. 66-69.

**11697 Status of Liquid-Metal-Heated Steam Generator Technology.** Summarizes the associated technology in its present status. ***Nyle A. Bischel.*** *U. S. Atomic Energy Commission, BAW*-1105, Sept. 1958, 56 pp. (UF767 Un.3.1ba Contin.)

*See also:* **11749** (lubrication of aircraft turbine engines); **12219** (thermodynamic and transport properties of gases, liquids, and solids).

## INFORMATION—PREPARATION AND DISSEMINATION

**11698 Crimes in Scientific Writing.** The author describes "grammatical mysteries" from his case book. ***Robert V. Kesling.*** *American Documentation*, v. 10, no. 3, July 1959, p. 173-175.

**11699 Scientific and Technical Information Services in Japan.** Discusses scientists, libraries, and union catalogs in Japan, and lists abstracting and bibliographical services available. *American Documentation*, v. 10, no. 3, July 1959, p. 176-191.

**11700 Abbreviations of Russian Scientific Serial Publications.** ***Eva Lou Fisher.*** *American Documentation*, v. 10, no. 3, July 1959, p. 192-208.

**11701 Citations in American Engineering Journals. III. Metallurgical Engineering.** The citation patterns in the literature of chemical and mechanical engineering were reported in two previous papers. This final report presents the findings for metallurgical engineering and summarizes the data for all three fields. ***Robert E. Burton.*** *American Documentation*, v. 10, no. 3, July 1959, p. 209-213.

**11702 An Integrated Approach to Documentation.** The author is particularly concerned with communication in the field of medicine. ***Richard H. Orr.*** *American Documentation*, v. 10, no. 3, July 1959, p. 214-220.

**11703 Library Service to Research Laboratories of a Large University.** The physical science librarian at Columbia University discusses the situation there. ***Russell Shank.*** *American Documentation*, v. 10, no. 3, July 1959, p. 221-223.

**11704 Determining Optimal Back Number Inventories.** Publishers of archival journals are confronted by a recurring problem. They must print, and store, more copies of their periodicals than are actually required to meet their current distribution needs, since the backnumber demand for such journals is usually substantial. How many copies to store and how long to store them are two questions that must be answered when setting an edition. ***Edward P. Tober.*** *American Documentation*, v. 10, no. 3, July 1959, p. 224-227.

**11705 Coordinate Indexing at the University of New Hampshire Library.** ***Duncan Brockway.*** *American Documentation*, v. 10, no. 3, July 1959, p. 228-231.

**11706 The Structure of "Semantic Coding", A Review.** An examination of the code for machine literature searching developed at Western Reserve University. ***B. C. Vickery.*** *American Documentation*, v. 10, no. 3, July 1959, p. 234-241.

**11707* How to Preserve Vital Records.** Possibility of enemy air attack makes it imperative that companies be current in reproduction of certain company data. *American Gas Association Monthly*, v. 41, nos. 7-8, July-Aug. 1959, p. 20-22.

**11708 Prodigy With a Flair for Profit.** Itek Corp., not yet two years old, tackles problem of storing vast quantities of business and scientific data—and makes money at it. *Business Week*, no. 1559, July 18, 1959, p. 78 + 3 pages.

**11709 Centralized Information Services.** This study was undertaken to analyze, systematize, and summarize the results of eight studies and surveys which have been carried out by the Center for Documentation and Communication Research during the past three years. These studies and surveys were directed to the investigation of the advantages and feasibility of centralized and cooperative information services. The purpose was not to prepare a definitive blueprint of services, procedures, etc., but rather to present an introductory analysis and summary which would clarify the goals and indicate the feasibility of future developments. ***Allen Kent and James W. Perry.*** 156 pp. 1958. Interscience Publishers, New York. (Z1001 K41c Over.)

**11710 Council on Library Resources, Inc. 2nd Annual Report for the Period Ending June 30, 1958.** Council is mainly concerned with problems of bibliographic access, physical access, and administrative arrangement of recorded knowledge in today's libraries. 1958. 43 pp. Council on Library Resources, Inc., Washington, D. C. (Pamphlet File)

**11711* The Presentation and Use of Information From the Work Process.** With the steadily increasing use of power in modern industry the worker is employed less and less for muscular strength of his arm, more and more for the abilities of his eye, ear and brain in handling information and making decisions. ***R. F. W. Crossman.*** *EPA Bulletin*, no. 32, June 1959, p. 27-34.

**11712 A Guide to Effective Report Writing.** The purpose of this guide is to outline in brief the basic principles of report writing with respect to organization of material and style. 2nd Ed. 30 pp. Mar. 1958. Industrial Relations News, New York. (P7 In2g Over.)

**11713* An Annotated Bibliography of Bibliographies Pertinent to the Design and Use of Machines by Human Operators.** This bibliography in the human factors field is based on the collection at Tufts University. A total of 117 references are given and discussed. ***Patrica S. Allen and Ezra V. Saul.*** *Human Factors*, v. 1, no. 1, Sept. 1958, p. 26-44.

**11714 Information Service in Libraries.** Discusses in detail various aspects of information services. It is mainly in scientific and industrial research that the "information service" or "information library" has developed most strikingly into its present characteristic form. ***D. J. Foskett.*** 142 pp. 1958. Crosby Lockwood & Sons Ltd., London. (Z675.T3 F78i)

**11715* Standardization in Film Cataloguing.** The author, chief cataloguer at the National Film Archive in England gives rules and terms used in his library and discusses other codes in general use. ***David Grenfell.*** *Journal of Documentation*, v. 15, no. 2, June 1959, p. 81-92.

**11716* Minimum Cost Document Reproduction in Large Lending Libraries.** Compares costs of microfilm, xerography, copyflo and other methods of reproduction. ***E. G. Hill.*** *Journal of Documentation*, v. 15, no. 2, June 1959, p. 93-99.

**11717* Standards for Special Libraries. Possibilities and Limitations.** ***Leon Carnovsky.*** *Library Quarterly*, v. 29, no. 3, July 1959, p. 168-173.

**11718* Audio-Visual Aids.** Recent developments and equipment at U.S. Army Command and General Staff College are described. ***W. C. Washcoe.*** *Military Review*, v. 39, no. 5, Aug. 1959, p. 51-66.

**11719* Science and the First "R".** Author believes that modern methods of teaching reading have an inadequate scientific basis. With a colleague he has devised a system for the elementary stage which is based on use of phonically regular words, and he argues for its wider adoption. ***Hunter Diack.*** *New Scientist*, v. 5, June 25, 1959, p. 1379-1381.

**11720 An Operations Research Study of the Dissemination of Scientific Information.** Investigates the production, distribution, and consumption of scientific communication, and seeks ways to increase scientific productivity in the communications field. ***Michael H. Halbert and Russell L. Ackoff.*** 56 pp. 1958. Operations Research Group, Case Institute of Technology, Cleveland. (Q175 C26.5o Over.)

**11721 One Battle We're Losing—And Why.** Why Russia exports 50% more books than we do, and what we can do to increase our foreign book trade. *Product Engineering*, v. 30, no. 27, July 6, 1959, p. 73-74.

**11722 Providing U. S. Scientists With Soviet Scientific Information.** Discusses form and extent of the Soviet information that should be made available in the U. S. and what actually is being done to make this information readily accessible to U. S. scientists. Rev. Ed. 36 pp. May 1959. National Science Foundation, Washington, D. C. (Z7407.R9 N21.7p)

**11723* Extrusion Bibliography.** Extrusion theory and analysis; extruder design and application. ***L. F. Street.*** *SPE Journal*, v. 15, July 1959, p. 561 + 3 pages.

*See also:* **11877** (bibliography on H-embrittlement of steel); **11976** (bibliography of intermetallic compounds).

## INSTRUMENTATION

**11724* Light Scattering. X. Photoelectric Apparatus for Measurement of Light Scattering and Observation of Sedimentation of Particles. XI. Visual Apparatus for Measurement of Light Scattering and Observation of Sedimentation of Particles. XIII. Application of Nomographs for the Zimm Method of Light Scattering.** (*In Czech.*) Rozptyl světla. X. Fotoelektrický přístroj pro měření rozptylu světla a sledování sedimentace částic. ***Blahoslav Sedláček and Emilie Chloubová.*** XI. Visuální přístroj pro měření rozptylu světla a sledování sedimentace částic. ***Blahoslav Sedláček.*** XIII. Použití nomogramů při zimmově metodě rozptylu světla.***Petr Munk and Jaroslav Nývlt.*** *Chemické Listy*, v. 53, no. 5, May 1959, p. 531-539.

**11725* Cam Program Controllers.** What they are, how they work, what they will—and won't do, and an idea or two about where to use them. ***R. G. Cameron.*** *Instrumentation*, v. 12, no. 3, May-June 1959, p. 8-13.

**11726 Contribution to a General Theory of Thermocouples.** Application of thermodynamics of irreversible processes to a thermocouple of which (a) the bars have an arbitrary shape, (b) the properties of the materials are arbitrary functions of temperature, and (c) the composition is, under certain restrictions, inhomogeneous and anisotropic, leads through introduction of a single place coordinate to two nonlinear differential equations describing the stationary distribution of temperature and electrical potential. ***A. H. Boerdijk.*** *Journal of Applied Physics*, v. 30, July 1959, p. 1080-1083.

**11727 Temperature Controller Based on Measurement of Rate-of-Change of Temperature.** The accuracy of the controller is affected only by the setting of the galvanometer modulator zero which is checked every few days. The controller is suitable for application to a wide variety of problems. ***A. B. Cairnie and J. D. Pullar.*** *Journal of Scientific Instruments*, v. 30, June 1959, p. 249-252.

**11728 The Epitasimeter: An Instrument for Process Control by Means of the Continuous Measurement of Surface Tension.** The instrument measures the ratio of surface tension to density. These two parameters are functions of concentration. The instrument can measure the concentration of very strong nitric acid directly. Another system to which the method can be successfully applied is that of ethanol/water. ***W. H. Aarts.*** *Journal of Scientific Instruments*, v. 30, June 1959, p. 252-255.

**11729 Apparatus for Measuring the Spreading Coefficient of a Liquid on a Solid Surface.** The apparatus described provides a direct-reading instrument for the measurement of the spreading coefficient of a liquid on a solid surface. The determination is based on the measurement of the maximum height of a sessile drop of the liquid-solid system. ***J. F. Padday.*** *Journal of Scientific Instruments*, v. 30, June 1959, p. 256-257.

**11730* A Piston Manometer up to 20,000 at.** The design and operation of the manometer are described. Calculations and test results are cited. (*In Russian.*) Porshnevoĭ manometr do 20,000 at. ***M. K. Zhokhovskiĭ, Iu. S. Koniaev, and V. G. Levchenko.*** *Pribory i Tekhnika Eksperimenta*, 1959, no. 3, May-June, p. 118-122.

**11731 New Electron Diffraction Apparatus for Continuous Recording.** A new electron diffraction device especially suited for investigation of diffusion problems, phase transitions, and reactions of solids with gases or other solids. It is equipped with a continuously recording camera where a 4 x 10 in. photoplate passes underneath a narrow slit exposed to the diffraction cone. Resulting photograph shows parallel diffraction lines instead of the usual Debye-Scherrer rings. ***R. Thun.*** *Review of Scientific Instruments*, v. 30, June 1959, p. 399-407.

**11732 Vacuum Adiabatic Heat Capacity Calorimeter.** Design, operation, and performance of a constant heating adiabatic vacuum calorimeter, suitable for measurement of heat capacities of corrosive, hygroscopic, easily oxidized, and slightly volatile materials in the temperature range from 50 to 460 C, are described. A sealed glass cell is used to protect the sample. ***H. Edward O'Neal and N. W. Gregory.*** *Review of Scientific Instruments*, v. 30, June 1959, p. 434-438.

**11733 Replica Method for Examining Surface Profiles.** A nondestructive method for the light microscope examination of surface profiles by means of replicas has been developed and applied to the examination of the surfaces of gear teeth. Possible extension of the method to electron microscope examination of the profiles of nearly smooth surfaces is described. ***A. P. Young and B. H. Clegg.*** *Review of Scientific Instruments*, v. 30, June 1959, p. 444-446.

**11734 Microscope Phase Fluorometer for Determining the Fluorescence Lifetimes of Fluorochromes.** A microscope which can measure the mean fluorescence lifetimes of small fluorescent samples is described. Special emphasis is given to fluorochromes dissolved in biological solutions and bound to thin polymeric substances, such as the desoxyribonucleic acid complexes present in the nuclei of cells. Fundamentally, the method is similar to that described by physicists and physicochemists for solutions of fluorochrome only. A diffraction modulator is used to sinusoidally modulate the intensity of a high-pressure Hg-vapor lamp. ***Benjamin D. Venetta.*** *Review of Scientific Instruments*, v. 30, June 1959, p. 450-457.

*See also:* **11254** (automated moisture control); **11545** (electronic timer); **11854** (quick-immersion thermocouples); **11910** (calorimeters).

## LUBRICATION AND FRICTION

**11735 Elastic and Damping Properties of Cylindrical Journal Bearings.** Derivation of equations; solution with arbitrary direction for the squeeze-film velocity; techniques for calculation of fluid stiffness and dissipation functions. ***B. Sternlicht.*** *ASME, Transactions, Series D, Journal of Basic Engineering*, v. 81, no. 2, June 1959, p. 101-108.

**11736 Axial, Relative Motion of a Circular Step Bearing.** Equations relating the flow of the lubricant and the axial motion of an externally pressurized thrust bearing are developed. Bearing is stable when the fluid is incompressible. Expressions for local stiffness and damping coefficients given, an analog computer solution of the equation of motion is compared with the results of the corresponding, small displacement equation. ***L. Licht.*** *ASME, Transactions, Series D, Journal of Basic Engineering*, v. 81, no. 2, June 1959, p. 109-117.

**11737 Friction and Wear of Metals to 1000 C.** Sliding experiments using the metals Zn, Cu, Ti, and 1020 steel were carried out on a pin-on-disk friction apparatus incorporated in a metallurgical furnace. ***E. P. Kingsbury and E. Rabinowicz.*** *ASME, Transactions, Series D, Journal of Basic Engineering*, v. 81, no. 2, June 1959, p. 118-122.

**11738 Characteristics of a Self-Lubricated Stepped Thrust Pad of Infinite Width With Compressible Lubricant.** Harrison's equation for the pressure in a gas-lubricated bearing of infinite width is solved for a thrust pad with stepped configuration. Analytic expressions for the pressure and load are developed. Numerical results are presented graphically. Determination of optimum design parameters is given by a pair of graphs. ***Kikuo C. Kochi.*** *ASME, Transactions, Series D, Journal of Basic Engineering*, v. 81, no. 2, June 1959, p. 135-146.

**11739 Energy Losses of Balls Rolling on Plates.** An apparatus for measuring the rolling force of a ball supported between two plates is described. Instantaneous values of the rolling force vary greatly from point to point on the sample surface and this variation is explained in terms of surface roughness and material homogeneity. The energy losses are shown as functions of load, material, and surface roughness. ***R. C. Drutowski.*** *ASME, Transactions, Series D, Journal of Basic Engineering*, v. 81, no. 2, June 1959, p. 233-238.

**11740 On the Effect of Lubricant Inertia in the Theory of Hydrodynamic Lubrication.** A theoretical study is made of the corrections required to the basic lubrication equations to allow for small effetcs of lubricant inertia in the laminar regime. The problem is approached by first determining the stream function for a wedge-shaped oil film with purely viscous flow and then obtaining the first-order correction for inertia. The effect of lubricant inertia is to cause a slight increase in the load capacity of a bearing. ***A. A. Milne.*** *ASME, Transactions, Series D, Journal of Basic Engineering*, v. 81, no. 2, June 1959, p. 239-244.

**11741 Surface Finish and Clearance Effects on Journal-Bearing Load Capacity and Friction.** A method of relating surface finish to minimum oil-film thickness and the corresponding load capacity of plain journal bearings is presented with supporting experimental data. The effect of clearance on load capacity and friction are shown on graphs indicating an optimum bearing clearance. ***F. W. Ocvirk and G. B. DuBois.*** *ASME, Transactions, Series D, Journal of Basic Engineering*, v. 81, no. 2, June 1959, p. 245-253.

**11742 A Theory of Oil Whip.** Oil whip was investigated theoretically and experimentally. It is shown that the inherent instability of the rotor in previous theories can be avoided by assuming zero pressure in place of negative pressure in the oil film and that the "inertia effect" in occurrences of oil whip can be understood by distinguishing small vibrations and large vibrations of the rotor. ***Yukio Hori.*** *ASME, Transactions, Series E, Journal of Applied Mechanics*, v. 26, no. 2, June 1959, p. 189-198.

**11743 On Critical Speeds of a Shaft Supported by a Ball Bearing.** Speeds have peculiar modes of vibrations which are determined by dimensions of ball bearings; one of them is motion of forward precession, the other is backward precession. Describes the cause of these critical speeds and the behavior of those vibrations. ***Toshio Yamamoto.*** *ASME, Transactions, Series E, Journal of Applied Mechanics*, v. 26, no. 2, June 1959, p. 199-204.

**11744* A Gas Film Lubrication Study. I. Some Theoretical Analyses of Slider Bearings. II. Numerical Solution of the Reynolds Equation for Finite Slider Bearings. III. Experimental Investigation of Pivoted Slider Bearings.** Important characteristics of such films are determined directly from the Reynolds Equation. Pressure, load, velocity, and geometry characteristics are presented for many compressible slider bearing films based upon computer solutions of a Reynolds difference equation. Cites experimental verification of computer solutions and describes experimental techniques. I. ***W. A. Gross.*** II. ***W. A. Michael.*** III. ***R. K. Brunner, J. M. Harker, K. E. Haughton, and A. G. Osterlund.*** *IBM Journal of Research and Development*, v. 3, no. 3, July 1959, p. 237-274.

**11745 Improvements in the Use of Radiotracers for Studying Wear in Piston Segments.** By collecting the oil moving down to the sump in a gutter at the bottom of the liner, a great improvement in sensitivity is obtained. Difference between the activity of this oil and that of the sump oil, by which the ring belt area is fed, is continuously registered. The curve obtained represents variations of instantaneous wear-rate, and by integrating the graph of oil volume versus activity, one can obtain the "apparent wear", as carried in the oil. (*In French.*) Améliorations dans l'utilisation des radiotraceurs pour l'étude de l'usure des segments de piston méthode IFP-RA3—bilan d'usure. ***Jean Thiéry.*** *International Journal of Applied Radiation and Isotopes*, v. 5, no. 3, May 1959, p. 197-203 + 1 plate.

**11746* Designing and Testing Journal Box Seals.** ***W. L. Stewart.*** *Lubrication Engineering*, v. 15, June 1959, 242 + 4 pages.

**11747* Investigation of the Mechanism of Tungsten Disulfide Lubrication in Vacuum.** Lubrication behavior was found to be similar to that of $MoS_2$. The steady-state value for the coefficient of friction at room temperature is 0.065. When sliding is resumed, following a "stop-time", the coefficient of friction is initially high. It drops rapidly, however, and approaches the equilibrium value within a few minutes. ***M. T. Lavik, G. E. Gross, and G. W. Vaughn.*** *Lubrication Engineering*, v. 15, June 1959, p. 246 + 4 pages.

**11748* Some Factors Affecting Performance of Large Pivoted-Pad Thrust Bearings.** ***E. C. Kuhn and G. D. Cooper.*** *Lubrication Engineering*, v. 15, June 1959, p. 250-255.

**11749* Some Considerations Relating to Lubrication of Aircraft Turbine Engines.** Describes requirement of present-day aircraft engines and discusses lubricants which are currently being used. ***Alfred B. Two.*** *Lubrication Engineering*, v. 15, July 1959, p. 280-285.

**11750* The Wright Air Development Center Gear Lubrication Research and Development Program.** Outline of programs presently underway. Apparatus and test procedures for determining scuff limited load and gear fatigue; effect of operating variables on test procedures. Plans for future work. ***H. R. Smith.*** *Lubrication Engineering*, v. 15, July 1959, p. 290-294.

**11751* Recommended Practices for Lubricating Passenger Car Ball Joint Front Suspensions.** Methods and sequence of servicing operations are explained in detail. ***NLGI Spokesman,*** v. 23, no. 5, Aug. 1959, p. 1-10.

**11752* Lubrication of Rolling Mill Gears and Bearings.** Layout of several rolling mill gear systems. Lubrication recommendations for specific operating speeds and conditions. ***J. H. Hitchcock.*** *NLGI Spokesman*, v. 23, no. 5, Aug. 1959, p. 167-170.

**11753* Low-Cost Engines for Lubricants Testing.** Describes three inexpensive engines for testing and evaluating lubricating oils. ***Norman Kendall.*** *SAE Journal*, v. 67, July 1959, p. 64-65.

**11754* Effects of Lube Oils on 2-Stroke Engines.** Laboratory studies show effect of detergents on piston cleanliness, effect of deposition of solid combustion products in the exhaust ports, engine wear, and spark-plugs. ***H. V. Lowther, G. H. Shea, and K. C. Kresge.*** *SAE Journal*, v. 67, July 1959, p. 72-74.

**11755* The Lubrication of Turbine Gearing.** Discusses "K" factor, scuffing, types of gear failure, pitting, tooth fracture, importance of good surface finish, and gear steels. ***G. H. Clark.*** *Scientific Lubrication*, v. 11, June 1959, p. 12 + 8 pages.

**11756* A New Type of Low-Friction Bearing.** New mercury bearing. (*In German.*) Eine neue Art der reibungsarmen Lagerung. ***Edgar Fischer.*** *VDI Zeitschrift*, v. 101, no. 18, June 21, 1959, p. 755-756.

***See also:*** **11965** (carbide precipitation in bearing steel).

## MECHANICAL ENGINEERING

**11757 Direct Measurement of Net Positive Suction Head.** Accurate method for measuring is described. Test information indicating its reliability and accuracy is presented. The test device consists of a vapor-pressure bulb that measures the vapor pressure of the liquid, a pressure tap that measures stagnation pressure and a pressure gage to indicate the difference between the two pressures. ***Robert B. Jacobs, Kenneth B. Martin, and Richard J. Hardy.*** *ASME, Transactions, Series D, Journal of Basic Engineering*, v. 81, no. 2, June 1959, p. 147-152.

**11758 Displacements and Stresses of a Laterally Loaded Semicircular Plate With Clamped Edges.** Solution is obtained for the case of the clamped semicircular plate of constant thickness, subjected to a uniformly distributed normal load. The method employed is superposition of solutions for a circular plate with fixed edges. Results are based on the assumption that the Kirchhoff, or small deflection, theory applies. ***W. H. Jurney.*** *ASME, Transactions, Series E, Journal of Applied Mechanics*, v. 26, no. 2, June 1959, p. 224-226.

**11759 Direct Determination of Stresses in Plane Elasticity Problems Based on the Properties of Isostatics.** An experimental method is developed for the calculation of stresses in plane elasticity problems. The method consists substantially in determining a function of the complex variable representing the field of isostatics. The method is applied to two particular problems of plane elasticity and a comparison of the results obtained by this method and by analytic methods is provided. ***Pericles S. Theocaris.*** *ASME, Transactions, Series E, Journal of Applied Mechanics*, v. 26, no. 2, June 1959, p. 227-234.

**11760* Torsion of a Square-Shaped Tube Clasped in at Both Ends.** ***P. Csonka.*** *Acta Technica Academiae Scientiarum Hungaricae*, v. 24, nos. 3-4, 1959, p. 379-390.

**11761* Photoelasticity.** . . . is a vital tool in stress analysis, can be used as a rough guide or with quantitative precision. ***C. R. Smith.*** *Aircraft and Missiles Manufacturing*, v. 2, Aug. 1959, p. 14-17.

**11762* An Approximate Partial Differential Equation for the Bending of an Unsymmetrical Composite Plate.** The primary plate is treated as a plate with bending stiffness, the secondary plate is treated as a membrane without bending stiffness, and the filler plate is treated as offering resistance to transverse shears and the transverse normal force only. Equation is derived using variational calculus methods. Basic equation of equilibrium for the plate is maintained by use of a Lagrangian multiplier. ***R. W. Woodhead.*** *Australian Journal of Applied Science*, v. 10, no. 2, June 1959, p. 123-137.

**11763* Control of Collapse Mechanisms in Triangulated Frames.** Unfavorable characteristics of compression members impose severe limitations in application of plastic theory methods to analysis of triangulated frames. Discusses limitations and shows how both mode of collapse and development of collapse mechanisms can be controlled in certain types of trusses. ***L. K. Stevens.*** *Australian Journal of Applied Science*, v. 10, no. 2, June 1959, p. 138-155.

**11764 Damping of Vibrations in Joints of Machine Parts.** Experimental study of vibration damping in butt and cylindrical joints, and in roller bearings. Dissipation of vibrational energy. Damping in cylindrical and tapered joints, in key and spline joints, and in bearings with rolling contacts. Equation for calculating relative damping in ball bearings. ***D. N. Reshetov and Z. M. Levina.*** *Henry Brutcher Translation No.* 4238, 26 pp. (From *Vestnik Mashinostroeniya*, v. 36, no. 12, 1956, p. 3-13.) Henry Brutcher, Altadena, Calif.

**11765* Elasticity Problem in the Case a Rigid Sphere Is Pressed on the Plane Surface of Semi-Infinite Elastic Solid.** The effect of friction on the contact surface is studied. ***Bunzai An.*** *Bulletin of JSME*, v. 2, no. 6, May 1959, p. 244-251.

**11766 Fluid-Power Controls.** Pumps, valves, hydraulic circuits, reservoirs, and other equipment. ***John J. Pippenger and Richard M. Koff.*** 1959. 252 pp. McGraw-Hill, New York. (TJ840 P66f)

**11767 Creep Stresses and Strains in an Axially Loaded Plate With a Hole.** An approximate method is developed for determining stresses and strains in a plate with a circular hole subjected to axial tension and accompanied by creep. ***Joseph Marin.*** *Franklin Institute, Journal*, v. 268, no. 1, July 1959, p. 53-60.

**11768 New Thermomechanical Reciprocity Relations With Application to Thermal Stress Analysis.** Equations are applicable to stationary and transient temperatures in elastic and viscoelastic structures. The methods are entirely variational and do not require the evaluation of the temperature field. ***M. A. Biot.*** *Journal of the Aero/Space Sciences*, v. 26, July 1959, p. 401-408.

**11769* A Method for Solving Linear Thermoelastic Problems.** ***R. J. Knops.*** *Journal of the Mechanics and Physics of Solids*, v. 7, no. 3, June 1959, p. 182-192.

**11770 Thermal Stresses in Design. XIII. Incremental Solutions for Plastic Stresses and Strains.** Plastic flow and creep formulations. ***S. S. Manson.*** *Machine Design*, v. 31, Aug. 6, 1959, p. 127-133.

**11771 Rotary Hydraulic Actuators.** Two single-acting pistons and a symmetrical involute-cam rocker arm are principal elements. The design is adaptable to any fluid-powered mechanism requiring torque transmission through oscillation of less than one-half revolution. Backlash is eliminated; no rotary high-pressure seals are used. ***L. H. Schwerdtfeger.*** *Machine Design*, v. 31, Aug. 6, 1959, p. 134-137.

**11772 Nonstandard Gears.** Calculation worksheet that simplifies design. ***John H. Glover.*** *Machine Design*, v. 31, Aug. 6, 1959, p. 139-144.

**11773 A Stroboscopic Vibration Analyzer.** Instrument enables an operator to quickly explore vibration patterns in a complex structure. Analyzer was developed for use in calibrating vibration pickups, where vibrations other than longitudinal were unwanted. By using several small pickups, it was possible to eliminate transverse or flexural vibrations. *National Bureau of Standards, Technical News Bulletin*, v. 43, July 1959, p. 122-123.

**11774 Friction Materials.** Asbestos and sintered friction materials; woven and molded linings. Research and development. ***A. A. K. Whitehouse.*** *Research*, v. 12, June 1959, p. 206-211.

**11775 Use of Capacity-Controlled rf Energized Ionization Transducer for Balancing Rotors.** The orbiting motion of a rotating shaft within its own fixed bearings is detected by capacitor probes. After passing through the transducer circuit, the signal is displayed on an oscilloscope. It is, therefore, possible to obtain the necessary balancing information at operating conditions. ***W. A. Gross.*** *Review of Scientific Instruments*, v. 30, July 1959, p. 522-523.

**11776* The Propagation of Plane Irrotational Waves Through an Elastoplastic Medium.** Investigation of wave propagation in a metal, treating interactions between elastic and plastic waves, and the formation and propagation of shock waves, in the general case of motions with unidirectional strain arising from an initial smooth loading-unloading pulse. The analysis is in terms of engineering stress and strain with a Lagrangian co-ordinate system. ***L. W. Morland.*** *Royal Society of London, Philosophical Transactions*, v. 251, Ser. A, Mathematical and Physical Sciences, no. 997, June 11, 1959, p. 341-383.

**11777* Note on Stress Concentrations in a Strip Under Tension and Containing an Infinite Row of Semicircular Notches.** A photoelastic study of the problem is presented. ***Akira Atsumi.*** *Tôhoku University, Technology Reports*, v. 23, no. 1, 1958, p. 21-30.

**11778* Stress Concentrations in a Strip Under Tension and Containing Two Infinite Parallel Rows of Holes.** Problem of determining stresses in an infinite strip of finite breadth under tension and containing two infinite parallel rows of holes placed longitudinally is studied theoretically. Results obtained are compared with those given by Chih-Bing Ling for an infinite strip having an unsymmetrically located perforating hole. ***Akira Atsumi.*** *Tôhoku University, Technology Reports*, v. 23, no. 1, 1958, p. 31-46.

**11779* Torsional Vibration of Shafts Carrying Discs.** Problem of torsional vibration of a circular shaft carrying discs is analyzed by considering the local effect at the contact surface between the shaft and discs. Numerical examples are given for a shaft carrying one or two discs and results obtained are compared with the ones from the approximate method of solution. ***Hideo Saito.*** *Tôhoku University, Technology Reports*, v. 23, no. 2, 1959, p. 103-115.

**11780 The Random Vibration of Elastic Strings—Theoretical.** The response of a perfectly flexible string with longitudinal deformation to random excitation is studied. The modified mean square response for the "elastic" strings is discussed and it is shown that the mean square deflection is diminished from the linear case. From a study of the fourth moments, it also appears that the shape of probability distributions of the transverse displacement are altered, the response to gaussian noise being in general non-gaussian. ***Richard H.***

*Lyon. U. S. Air Force, Wright Air Development Center, WADC Technical Report* 58-570, May 1959, 20 pp. (TL507 Un3.18w Vis.)

**11781 Steady-State and Transient Thermal Stresses in a Tube Subjected to Internal Heating.** Method of solution is presented for thermal stresses caused by either steady-state or transient heat flow in an internally heated tube. Heat conduction equations are solved by the method of finite differences and are programmed for solution by high-speed digital computers. By coding the problem for computers of this type, thermal stresses for tubes of different materials, thermal properties, and heat-generation histories are readily attainable. ***H. A. Eagle and A. L. Ross.*** *U. S. Atomic Energy Commission, APEX*-460, (Rev.) Oct. 1955, (Issued May 1959), 32 pp. (UF767 Un3.1ap Contin.)

**11782 Thermal Stress Analysis of Finite Sections.** A general method is described for finding the thermal stresses in finite, simply connected regions. The method is applicable to plane-stress or plane-strain problems and makes use of the analogy between the problems of the bending stresses of clamped plates and those of thermal-plane stresses. ***Arthur L. Ross.*** *U. S. Atomic Energy Commission, APEX*-480, Jan. 20, 1959, 16 pp. (UF767 Un3.1ap Contin.)

**11783* Dry-Operating-Piston Reciprocating Compressor. III. Experiments on the Effect of Extremely Dry Technical Gases on the Life of Dry-Operating Materials in Piston Compressors.** Experiments showed that acceptable life for artificial C in piston rings can be obtained only in cases when the cylinder is very smooth and previously treated with graphite and Mo disulfide. Life of 1500-5000 hrs. or more were reached with piston rings constructed from hard, artificial C, saturated with metals. (*In German.*) Trockenlauf-Kolbenverdichter. III. Versuche über den Einfluss extrem trockener technischer Gase auf die Standzeit von Trockenlaufwerkstoffen in Kolbenverdichtern. ***Erwin Weis.*** *VDI Zeitschrift*, v. 101, no. 19, July 1, 1959, p. 777-788.

**11784 Fundamental Engineering Kinematics.** Method for locating instant centers; cubic angular velocity ratios; graphic determinations of linear velocities; gear train analysis. ***L. A. Padis and W. C. Lyford.*** *Virginia Polytechnic Institute, Bulletin, Engineering Experiment Station Series no.* 131, Mar. 1959, 96 pp. (TN21 V81b Vis.)

*See also:* **11175** (hydraulic equipment for aircraft); **11927** (design of machine tools); **12239** (designing with butyrates); **12276** (O-rings).

## METALLURGY

**11785* Molybdenum in Alloy Steel Castings.** Alloy steels, giving superior mechanical properties, can be reliably obtained on a foundry basis. Small additions of Mo increase the hardenability, reduce temper brittleness, and give usefully high creep resistance at moderately high temperatures. ***G. French and B. H. C. Waters.*** *Alloy Metals Review*, v. 9, no. 91, Mar. 1959, p. 2-11.

**11786* Contribution to the Manufacture of Metal Filaments.** Description of manufacturing methods. New method of manufacture of Al filaments by die-castings and use of these filaments. (*In Czech.*) Příspěvek k výrobě kovových vláken. ***Luděk Krátký.*** *Hutnické Listy*, v. 14, no. 6, June 1959, p. 499-500.

**11787 Observations on Steelmaking Research in the USSR.** ***John F. Elliott.*** *Journal of Metals*, v. 11, July 1959, p. 465-467.

**11788 Aluminum Foil Laminating.** Alloys and their properties; laminating; adhesives; coating. *Light Metal Age*, v. 17, June 1959, p. 8 + 2 pages.

**11789 X2219-T6 High Temperature Aluminum Alloy.** This alloy contains Cu, Mn, and small quantities of V and Zr. It exhibits attractive properties after exposure of 100 hours to temperatures of 500 to 600 F. ***Paul L. Hendricks.*** *Light Metal Age*, v. 17, June 1959, p. 11-13.

**11790 Tailor Made Alloys.** The fundamental theory of the structure of metals and an indication of how theoretical knowledge may be of practical value in the formulation of alloys. ***D. A. Robins.*** *Metal Industry*, v. 94, June 19, 1959, p. 501 + 4 pages.

**11791 Tough Ship Plate.** A review of work done since 1946 by the Ship Structure Committee leads to the conclusion that a vanishing number of failures need be expected in normal service of welded ships properly designed and constructed of steels meeting the revised specifications of the American Bureau of Shipping. ***William J. Harris, Jr. and Clyde Williams.*** *Metal Progress*, v. 75, no. 4, Apr. 1959, p. 66-71.

**11792 Titanium Alloys Today—How Commercial Alloys Compare.** Divided into $\alpha$, $\alpha$-$\beta$, and $\beta$ types, commercial Ti alloys have widely varying properties. Alpha alloys have high strength and good oxidation resistance at elevated temperatures, but cannot be heat treated readily. Alpha-beta and $\beta$ alloys respond to heat treatment and are more formable than $\alpha$ alloys. Research and development programs will broaden applications. ***Paul D. Frost.*** *Metal Progress*, v. 75, no. 4, Apr. 1959, p. 91-96.

**11793* High-Silicon Alloy Brightens Aluminum's Prospects for Auto Engine Castings.** Low coefficient of expansion, plus high hardness and wear resistance, make hypereutectic Al-Si alloy a strong candidate for engine blocks and other automotive castings. ***Oldrich Tichy and Rolf Kissling.*** *Modern Metals*, v. 15, no. 6, July 1959, p. 42 + 2 pages.

**11794 The Nimonic Alloys.** Constitution, identification, fabrication, properties, and applications. ***W. Betteridge.*** 332 pp. 1959. Edward Arnold (Publishers) Ltd., London. (TA490 B46.6n)

**11795* Study of an Extra Low Carbon Non Aging Steel With Special Magnetic Properties.** A low coercive force and high magnetic permeability steel was tested for use in a proton synchrocyclotron. (*In French.*) Étude d'un acier extra-doux non sujet au vieillissement présentant des caractéristiques magnétiques spéciales. *Revue de Métallurgie*, v. 56, May 1959, p. 425-434.

**11796* Use of Radioactive Indicators in Studying the Distribution and the Behavior of Admixtures in the Production of Alloys.** Ionization and radiography were used in developing a method with $Cr^{51}$, $Cu^{64}$, $Zn^{65}$, $Zr^{95}$, $W^{185}$ for the production by melting of some Al-based alloys, for the distribution of the admixtures and for the study of their conduct during subsequent machining. (*In Russian.*) Ispol'zovanie radioaktivnykh indikatorov dlia izucheniia raspredeleniia i povedeniia primesei pri proizvodstve splavov. ***T. A. Potapova and S. T. Prokhorov.*** *Tsvetnye Metally*, v. 32, no. 5, May 1959, p. 78-80.

**11797 Studies of Solid State Reactions in High Temperature Alloy Systems.** Studies of matrix and oxidized surface of Ni-Cr alloys. ***J. F. Radavich.*** *U. S. Atomic Energy Commission, APEX*-483, Oct. 29, 1958, 17 pp. (UF767 Un3.1ap Contin.)

*See also:* **11218** (refractories for Al); **11519** (Pb-Sn-Ba alloy).

## METALS—CORROSION

**11798* Influence of Sea Water on Corrosion of Reinforcement.** Over 400 reinforced mortar prisms mixed with water from the Mediterranean Sea were tested for corrosion of reinforcement at ages ranging from 3 months to 4 years. Variables studied were water-cement ratio, cement content, and storage conditions. ***R. Shalon and M. Raphael.*** *American Concrete Institute, Journal*, v. 30, *ACI Proceedings*, v. 55, no. 12, June 1959, p. 1251-1268.

**11799* Role of Oxide Plasticity in the Oxidation Mechanism of Pure Copper.** The mechanism of the oxidation of high-purity Cu was studied at temperatures from 500 to 981 C employing gravimetric, high-temperature microscopic and inert marker techniques. An investigation of the adhesion of Cu oxides was also made. ***J. A. Sartell, R. J. Stokes, S. H. Bendel, T. L. Johnston, and C. H. Li.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 3, June 1959, p. 420-424.

**11800 Determination of Susceptibility to Intergranular Corrosion of Welds in Structures.** Nondestructive test using higher-C 18-8 Ti steel. ***N. D. Tomashov and O. G. Deryagina.*** *Henry Brutcher Translation No.* 4461, 8 pp. (From *Zavodskaya Laboratoriya*, v. 23, no. 6, 1957, p. 679-682.) Henry Brutcher, Altadena, Calif.

**11801 A New Experimental Technique for the Study of Films Produced at Electrochemical Interfaces.** Technique for studying corrosion films consists of applying a square wave current superimposed on a constant d-c current. The a-c current charges and discharges the double layer capacity at a high frequency. From the voltage transients produced by this current, as observed with an oscilloscope, the nature of the electrode interface can be studied. ***B. D. Cahan and P. Rüetschi.*** *Electrochemical Society, Journal*, v. 106, July 1959, p. 543-547.

**11802 Oxygen Overvoltage and Electrode Potentials of Alpha- and Beta-$PbO_2$.** Buildup and decay of O overvoltage on α- and β-$PbO_2$ was studied. Layers of the two $PbO_2$ modifications were electrodeposited on Pt wires, sealed at both ends into glass. Initial buidup of O overvoltage at constant current is linear with time, and decay on open circuit is logarithmic with time. ***P. Rüetschi, R. T. Angstadt, and B. D. Cahan.*** *Electrochemical Society, Journal*, v. 106, July 1959, p. 547-551.

**11803 The Significance at the Flade Potential.** Previous explanations of the Flade potential are reviewed. A new explanation based on a single phase passive film of γ-$Fe_2O_3$ having nonuniform defect concentration and type is advanced. ***M. J. Pryor.*** *Electrochemical Society, Journal*, v. 106, July 1959, p. 557-562.

**11804 Potential Studies on Passivity to Corrosion Induced by Pretreatment Processes. II. Comparative Study of Chromate Treatment and Chromate Inhibition.** ***K. S. Rajagopalan and K. Balakrishnan.*** *Electrochemical Society, Journal*, v. 106, July 1959, p. 562-566.

**11805 Kinetic Studies on Corrosion Systems. I. Polyelectrodes Under Activation Control. II. The Reduction of Cupric Ion on Passive Stainless Steel Electrodes.** I. ***Franz A. Posey.*** II. ***Franz A. Posey, G. H. Cartledge, and R. P. Yaffe.*** *Electrochemical Society, Journal*, v. 106, July 1959, p. 571-589.

**11806 Titanium-Noble Metal Alloys Greatly Heighten Resistance to Corrosion.** Addition of a small amount of some noble metals—0.1% Pd, for instance, decreases the rate of corrosive attack to less than 0.01 inches per year. This remarkable improvement can also be achieved by small additions of most of the other noble metals—Pt, Re, Ru, Ir, Os, and Rh. Titanium-Pd has identical properties of unalloyed Ti. *Light Metal Age*, v. 17, June 1959, p. 14 + 2 pages.

**11807* Corrosion Resistance of Type 347 Stainless After "Sensitizing" Heat Treatments.** Corrosion rates in boiling $HNO_3$ after a systematic series of long heatings between 700 and 1500 F can be plotted in TTS (time-temperature-sensitization) diagrams so engineers can avoid fabrication practices which would produce unexpected damage from corrosive liquids. ***Hilmer F. Ebling and Merrill A. Scheil.*** *Metal Progress*, v. 76, no. 1, July 1959, p. 94-97.

**11808* Stress Corrosion—The Engineer's View.** Choice of metals known to be susceptible to stress corrosion. Means for use in design and manufacture to avoid trouble. Al-Zn, Al-Cu, and other alloys. ***P. H. Wall.*** *Royal Aeronautical Society, Journal*, v. 63, June 1959, p. 354-365.

**11809 An Investigation of Scaling of Zirconium at Elevated Temperatures.** ***H. B. Probst, E. B. Evans, and W. M. Baldwin, Jr.*** *U. S. Atomic Energy Commission, AECU-3706*, June 4, 1959, 3 pp. (UF767 U3au Contin.)

**11810 Construction Materials for the Hydrofluorinator of the Fluoride-Volatility Process.** Nine materials were evaluated. The metals were exposed to molten fluoride salts through which HF was bubbled continuously. INOR-8 was the most promising of the materials tested. ***Paul D. Miller, et al.*** *U. S. Atomic Energy Commission, BMI-1348*, June 3, 1959, 42 pp. (UF767 U3b Contin.)

***See also:*** **11250** (effect of water composition on steel corrosion).

## METALS—EXTRACTION AND REFINING

**11811* Thermodynamic Treatment of Disproportionation Equilibria Involving Complex Ion Formation in Molten Salts.** Mathematical and theoretical analysis of the equilibrium between Ti metal, $TiCl_2$, and $TiCl_3$ in a solvent of molten metal chlorides. ***K. Grjotheim and J. M. Toguri.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 3, June 1959, p. 403-407.

**11812* The Preparation of High-Purity Uranium Metal by the Bomb Reduction of Uranium Tetrafluoride With Calcium.** ***R. W. Kewish, et al.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 3, June 1959, p. 425-429.

**11813* Iodide Columbium.** Preparation by thermal decomposition of Cb iodide(s) on an indirectly heated quartz surface. ***R. F. Rolsten.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 3, June 1959, p. 478-483.

**11814 Production of Transformer Steel in Vacuum Furnaces.** Comparison of properties of transformer steel produced in ordinary and in vacuum-induction furnaces. ***G. A. Garnyk and A. M. Samarin.*** *Henry Brutcher Translation No.* 4362, 20 pp. (From "Primenenie Vakuuma v Metalurgii" (Use of Vacuum in Metallurgy), Moscow, 1958, p. 14-34). Henry Brutcher, Altadena, Calif.

**11815 Semicontinuous Casting of Stainless Steel.** Especially Ti-stabilized 18% Cr, 8% Ni steel. ***M. S. Boichenko, O. T. Gavrilov, Yu. B. Kan, and B. Z. Kononov.*** *Henry Brutcher Translation No.* 4470, 13 pp. (From *Stal'*, v. 18, no. 11, 1958, p. 983-987.) Henry Brutcher, Altadena, Calif.

**11816 Heating Problems in Industrial-Scale Degassing of Liquid Steel.** Resistance heating with hairpin elements vs. bar elements and arc heating. ***H. Knüppel, K. Brotzmann, K. Rüttiger, and A. Diener.*** *Henry Brutcher Translation No.* 4561, 14 pp. (From Stahl und Eisen, v. 79, no. 5, 1959, p. 272-276.) Henry Brutcher, Altadena, Calif.

**11817 Prospects for Using Low-Grade Manganese Ores in the Production of Ferromanganese and Silicomanganese.** Economics of use of high-phosphorus oxide or carbonate Mn ores in electric furnaces. ***E. M. Alekseev.*** *Henry Brutcher Translation No.* 4562, 15 pp. (From *Stal'*, v. 18, no. 7, 1958, p. 617-620.) Henry Brutcher, Altadena, Calif.

**11818 Grain of Solidifying Metal Refined by Vibration.** Experiments on applying low-frequency vibrations directly to the solidfying metal instead of the mold to study the feasibility of refining the grain in this way. ***I. I. Novikov, G. A. Korol'kov, V. V. Solov'eva, and A. Freilikh.*** *Henry Brutcher, Translation No.* 4563, 5 pp. (From *Liteinoe Proizvodstvo*, 1959, no. 2, Feb., p. 42.) Henry Brutcher, Altadena, Calif.

**11819 Temperatures of Incipient Reduction of Metal Oxides by Solid Carbon.** ***V. P. Elyutin, R. F. Merkulova, and Yu. A. Pavlov.*** *Henry Brutcher Translation No.* 4597, 13 pp. (From *Proizvodstvo i Obrabotka Stali i Splavov*, Collection of Papers No. 38 from the Moscow Steel Institute. Published by Metallurgizdat, Moscow, 1958, p. 79-87.) Henry Brutcher, Altadena, Calif.

**11820 Control Measurements in Degassing of Liquid Steel in Vacuum.** Processes which can be measured in degassing by the vacuum-lift process; conclusions which can be drawn from the measured values. ***K. Brotzmann, K. Rüttiger, K. Förster, and R. Hentrich.*** *Henry Brutcher Translation No.* 4601, 15 pp. (From *Stahl und Eisen*, v. 79, no. 7, 1959, p. 410-414.) Henry Brutcher, Altadena, Calif.

**11821 Elimination of Oxygen During the Vacuum Treatment of Liquid Steel.** Experience in vacuum degassing of C and Cr alloyed steels. ***H. Knüppel, A. Drevermann, and F. Oeters.*** *Henry Brutcher Translation No.* 4602, 20 pp. (From *Stahl und Eisen*, v. 79, no. 7, 1959, p. 414-419. Henry Brutcher, Altadena, Calif.

**11822 Experience With Vacuum Stream Degassing of Steel.** ***A. Tix, G. Bandel, W. Coupette, and A. Sickbert.*** *Henry Brutcher Translation No.* 4605, 16 pp. (From *Stahl und Eisen*, v. 79, no. 8, 1959, p. 472-477.) Henry Brutcher, Altadena, Calif.

**11823 Vacuum Arc Melting and Casting of Titanium.** The second and concluding portion of a report on results of a Naval Research Laboratory investigation of the feasibility of vacuum arc melting and casting of titanium. ***R. W. Huber, E. J. Chapin, and I. R. Lane, Jr.*** *Foundry*, v. 87, July 1959, p. 86-90.

**11824* Dependence of Specific Consumption of Coke on the Melting Intensity in Blast Furnace. (Experiences From Peoples' China).** Describes how Chinese furnacemen improved technical and economical performance of blast furnaces. (*In Czech.*) Výzkum závislosti specifické spotřeby koksu na intensitě tavení ve vysoké peci. (Zkušenosti z činské lidové republiky.) ***Antonín Bichler.*** *Hutnické Listy*, v. 14, no. 6, June 1959, p. 476-478.

**11825* Quality of Rimmed Steel Produced in Oxygen-Blast Converter From High Phosphorus Pig Iron.** Technological and mechanical properties of O-blast steel produced from pig iron with up to 0.8% P are equal to open-hearth steel. (*In Czech.*) Jakost neuklidněné oceli vyrobené v kyslíkovém konvertoru ze surového železa s vyšším obsahem fosforu. ***František Krumnikl and Rudolf Strobl.*** *Hutnické Listy*, v. 14, no. 6, June 1959, p. 493-499.

**11826* Modification of the L. D. Process for the Treatment of Basic Pig Iron.** Modern methods have been developed, such as the "Oxygen-Powder-Blower", the "Oxygen-Pulverized Lime" and the "Phoenix Blower Method" for treating basic Bessemer pig by blowing O on the bath. They are better than the "Linz Tuyere Process". Average C content steel can be made and the Bessemer slag obtained is suitable for introducing additives. (*In Czech.*) Modifikace LD pochodu pro zpracování Thomasova surového železa. ***Jaroslav Bečvář.*** *Hutník (Czech)*, v. 9, no. 6, June 1959, p. 185-189.

**11827* Effects of Casting Technique and of Coat of Mold on Quality of Ingot.** Defects in ingots and their causes. Mold casting methods and coatings of organic and inorganic origin. Bituminous lacquers or benzene resins give best results. (*In Czech.*) Vliv lití technologie a kokilových nátěrů na jakost ingotů. ***Lubomír Šmrha.*** *Hutník (Czech)*, v. 9, no. 6, June 1959, p. 190-194.

**11828* Mechanizing Open-Hearth Furnace Repairs.** Productivity can be raised by reducing the time for cold maintenance by mechanizing such processes as demolition of worn masonry, removal of slag from slag spaces, loading, classification, and evacuation of the broken material, and transportation of fire-resistant brick, cement and powders. (*In Czech.*) Mechanizace oprav martinských pecí. ***Karel Říha.*** *Hutník (Czech.)*, v. 9, no. 6, June 1959, p. 195-199.

**11829 Vacuum Pouring of Ingots for Heavy Forgings. III.** Description of properties resulting from vacuum pouring. ***J. H. Stoll.*** *Industrial Heating*, v. 26, July 1959, p. 1363 + 5 pages.

**11830 Investigations and Control of Open Hearth Production Problems.** Application of statistical methods to production rates. Study of factors influencing heating times. ***A. V. Lang and T. A. Cleary, Jr.*** *Industrial Heating*, v. 26, July 1959, p. 1374 + 6 pages.

**11831 Ultrasonics Cuts Grain Growth During Casting of Forging Ingot.** Tests on a 600-lb. ingot points up the benefits of ultrasonic treatment on a larger scale in vacuum arc furnace. ***E. B. Wright, D. R. Carnahan, and J. H. Kelley.*** *Iron Age*, v. 184, no. 6, Aug. 6, 1959, p. 84-87.

**11832 The Development and Present State of the LD Process.** The LD process is easily adaptable to specific production requirements. The economy of the process was clearly revealed during the industrial recession of the past years. The rapidity of the process reactions requires operating personnel of considerable mental and physical skill. ***O. Cuscoleca and K. Rösner.*** *Iron and Steel Institute, Journal*, v. 192, pt. 2, June 1959, p. 147-153.

**11833* Effects of Silicon and Manganese in Pig Iron on the Dephosphorizing Process During Melting Period When Blowing Oxygen Through the Bath.** With more O introduced into the bath during the initial melting period, effect of the Si content on the dephosphorizing process decreases; it completely disappears at a consumption of 1500 to 2000 $m^3$ per hour. Increasing the Mn amount in the melt, without applying O, eliminates P in the first half of the melting period. With O blowing, more Mn has a negative effect on dephosphorization. (*In Russian.*) Vliianie kremniia i margantsa chuguna na protsess defosforatsii v period plavleniia pri produvke vanny kislorodom. ***V. P. Grigor'ev and E. V. Abrosimov.*** *Izvestiia Vysshikh Uchebnykh Zavedenii, Chernaia Metallurgiia*, 1959, no. 4, Apr., p. 45-51.

**11834 Ram Reactor Provides Continuous Zirconium Production.** Description of process for Zr production on a continuous basis, yielding reactor-grade Zr or Zircaloy, with a high efficiency and low operating cost. ***W. W. Dunham, Jr. and R. D. Toomey.*** *Journal of Metals*, v. 11, July 1959, p. 438-440.

**11835 Zirconium by Sodium Reduction.** Production of reactor-grade Zr at one of the largest and most modern plants, the Ashtabula, Ohio, plant of Mallory-Sharon Metals Corp. ***F. Weston Starratt.*** *Journal of Metals*, v. 11, July 1959, p. 441-443.

**11836 Steelmaking/U. S. A.** Summation of the steelmaking industry over the first one hundred years. ***Leo F. Reinartz.*** *Journal of Metals*, v. 11, July 1959, p. 444-448.

**11837 Predicting Minimum Materials Cost for Stainless Steels.** A linear programming model of Type 430 stainless steel melting process has been devised from the technical and practical factors involved. Although further refinement of the model is presumably desirable to make it applicable to specific shops and furnaces, the technique appears to have great potential as a guide to design of the most economical practice for using available materials in production of stainless steel. ***D. C. Hilty, R. W. Taylor, and R. H. Gillespie.*** *Journal of Metals*, v. 11, July 1959, p. 458-464.

**11838 Soviet Vacuum Metallurgy.** Russian developments in induction and arc melting, degassing, desulfurization, rolling, and ultrasonic treatment. ***A. M. Aksoy.*** *Journal of Metals*, v. 11, July 1959, p. 468-470.

**11839* The Viscosity Behavior of Synthetic Slags as Dependent on Composition and Temperature.** Studies in the $CaO$-$MgO$-$SiO_2$-$Al_2O_3$ system. (*In German.*) Viskositätsverhalten von synthetischen schlacken in Abhängigkeit von der Zusammensetzung und der Temperatur. ***Erich E. Hofmann.*** *Stahl und Eisen*, v. 79, no. 12, June 11, 1959, p. 846-854.

**11840* Research on the Activity of Components in the Fundamental System in Iron Blast Furnace Slag. I. Measurement of the Activity of Silica in the System of $CaO$-$SiO_2$ and $CaO$-$SiO_2$-$Al_2O_3$.** ***Koji Sanbongi and Yasuo Omori.*** *Tôhoku University, Science Reports of the Research Institutes, Ser. A. Physics, Chemistry, Metallurgy*, v. 11, no. 3, June 1959, p. 244-263.

**11841 Decontamination of Thorium-Uranium Alloys by Consumable Arc-Melting.** Cesium and Sr removals of up to 75% were obtained, whereas Ce and rare earth removals were less than 20%. Metal loss increases with increasing power to the arc. Method is not suitable for a decontamination process but could be utilized as a step in a low-decontamination, reprocess-

ing method. ***R. E. Johnson and E. W. Murbach.*** *U. S. Atomic Energy Commission, NAA-SR-3590,* June 15, 1959, 15 pp. (UF767 Un3.1na Contin.)

## METALS—FINISHING, POLISHING, AND CLEANING

**11842*** **Abrasive Blasting in the Shipping Industry.** British abrasives, equipment, and techniques. ***P. B. Wharton.*** *Corrosion Prevention & Control,* v. 6, June 1959, p. 59-60.

**11843*** **A Review of Barrelling and Abrasive Blasting.** "Rotofinish", "Polymotion", "Vaguablast", "Aquablast", and other systems. *Corrosion Prevention & Control,* v. 6, June 1959, p. 61-66.

**11844** **New Oil Cleans as Its Quenches.** Gulf "Super-Quench" oil provides fast cooling through the critical hardening range and a slow quench through the lower temperature range. The fast quenching power of the oil is its chief asset in producing clean finishes, while its slow cooling in the final stage of quenching tends to reduce distortion and maintain tolerance. *Iron Age,* v. 184, no. 6, Aug. 6, 1959, p. 81.

**11845*** **Surface Finishing Stainless Steels.** Types of stainless steels; commercial mill finishes; sequence of operations for grinding, polishing and buffing; selection of sheet finishes; characteristics of the stainless steels; recommended procedures. ***Lester F. Spencer.*** *Metal Finishing,* v. 57, July 1959, p. 48 + 6 pages.

**11846*** **Better Buffing Thru Better Buff Design.** Various buffs and their uses. ***Stanley P. Sax.*** *Metal Finishing,* v. 57, July 1959, p. 54-58.

**11847*** **Descaling Wire Rods by Shot-Blast.** A continuous line for drawing wire at 300 ft. per min. depends on a shot-blast method for descaling. Costs are comparable to conventional methods, and the pollution problem (from acid pickling baths) is avoided. ***K. J. Sorace.*** *Metal Progress,* v. 76, no. 1, July 1959, p. 98-100.

**11848*** **Recent Tests on Economical Cleaning of Unalloyed Low-Carbon Steel in Sulphuric Acid, Using a Wetting Agent.** Pickling of wire products. Effects of wetting agents and inhibitors. ***C. A. Fischer.*** *Wire Industry,* v. 26, July 1959, p. 647 + 3 pages.

## METALS—FOUNDRY PRACTICE

**11849** **Desulfurization of Liquid Cupola Iron by Magnesium.** Use of radioisotope S-35. ***B. S. Mil'man, L. V. Il'icheva, and M. A. Studnits.*** *Henry Brutcher Translation No.* 4518, 7 pp. (From *Liteinoe Proizvodstvo,* v. 9, no. 11, 1958, p. 15-17.) Henry Brutcher, Altadena, Calif.

**11850*** **Influence of Vacuum-Melting on the Structure and Mechanical Properties of Cast Iron.** Effects of very small amounts of gaseous elements or non-metallic inclusions contained in cast Fe and a vacuum-melting procedure to eliminate these inclusions. ***Ichiro Iitaka and Masao Kikuchi.*** *Castings Research Laboratory, Waseda University, Report No.* 9, 1958, p. 1-10.

**11851*** **Fundamentals of the Manufacturing Process of Calcium Treated S-G Iron and Effects of the Combined Addition of Calcium and Cerium.** ***Takazi Kusakawa.*** *Castings Research Laboratory, Waseda University, Report No.* 9, 1958, p. 11-14.

**11852*** **Gases in Aluminium Bronzes.** Gas pick-up in the melt of ternary 87% Cu-10% Al-3% Fe system. ***Shigeo Oya and Umewo Honma.*** *Castings Research Laboratory, Waseda University, Report No.* 9, 1958, p. 31-34.

**11853** **Casting Integrity.** A discussion of the degree of soundness, strength, ductility, or other necessary properties as a function of a casting's suitability for the purpose for which it was designed. ***Clyde L. Frear.*** *Foundry,* v. 87, July 1959, p. 80-85.

**11854** **Thermocouple Practice in Ferrous Foundry. Temperature Control.** Quick-immersion thermocouples provide close control of casting conditions and furnish permanent records of the temperatures of individual melts. ***H. O'Conner.*** *Foundry,* v. 87, July 1959, p. 98-99.

**11855** **Foundry Research and Development in the Post-War Period.** The field embraced by the cast metals industry; recent progress in cast irons, melting and molding practices, novel processes, steelfounding, non-ferrous research productivity, and health and safety matters. ***J. G. Pearce.*** *Foundry Trade Journal* (Special Issue), v. 106, May 1959, p. 9 + 6 pages.

**11856** **Foundry Melting Equipment Review—Trends in Non-Ferrous, Steel and Iron Foundries. I. Melting in Non-Ferrous Shops. II. Foundry Steelmaking. III. Developments in Melting Equipment for Ironfounders.** I. ***D. W. Brown.*** II. ***T. A. Cosh.*** III. ***W. J. Driscoll.*** *Foundry Trade Journal* (Special Issue), v. 106, May 1959, p. 15-24.

**11857** **Patternmaking Progress.** Includes data on wooden equipment, resin patterns, metal equipment, pressure-cast aluminum plates, and capital investment. ***W. D. Hartley.*** *Foundry Trade Journal* (Special Issue), v. 106, May 1959, p. 25-28.

**11858** **Modern Foundry Mechanization.** Progress and obstacles in the United Kingdom. ***J. Bain.*** *Foundry Trade Journal* (Special Issue), v. 106, May 1959, p. 29-34.

**11859** **Clean Air for Foundries.** Implications of British regulations. Dust and smoke suppression, fume extraction, etc. ***W. H. White.*** *Foundry Trade Journal* (Special Issue), v. 106, May 1959, p. 35-40.

**11860** **Survey of Foundry Practices: Modern Foundry Metals and Processes. I. Steel Castings—Their Manufacture and Use. II. The Cast-Iron "Family" of Metals. III. Technological Development in the Copper-Base-Alloy Foundry Industry During Post-War Years. IV. Aluminium-Alloy Founding: Review of Post-War Progress in the UK. V. Magnesium Founding—25 Years of Progress.** I. ***C. J. Dadswell.*** II. ***W. W. Braidwood.*** III. ***A. R. French.*** IV. ***F. H. Smith.*** V. ***V. P. A. Fisher.*** *Foundry Trade Journal* (Special Issue), v. 106, May 1959, p. 41-63.

**11861** **25th International Foundry Congress.** A collection of various studies performed in connection with the 25th International Foundry Congress organized in Belgium by the Technical Foundry Association. Among other topics, discusses man and labor in the foundry, effect of ladle additions on cast iron, investigations of nonmagnetic Ni-Cu-Mn cast irons, and metallic Chaplets. (*In French, German, and English.*) 25 ème Congrès international de fonderie. 735 pp. 1958. L'Association technique de fonderie de Belgique, Liège, Brussels. (TS200 In8p)

***See also:*** **11219** (refractories for Al); **11785** (Mo in alloy steel castings); **11793** (Al-Si alloy for engine block castings); **11844** (quenching oil); **11884** (oxygen-blowing of cast iron); **11885** (melting red brass).

## METALS—HEAT TREATMENT

**11862** **Distortion of Steel Surface-Hardened by Induction Heating.** Study of 0.45 C steel; 0.40 C, 0.60 Cr, 1.25 Ni steel; and 0.40 C, 0.90 Cr steel. ***Yu. M. Bogatyrev and V. P. Eremina.*** *Henry Brutcher Translation No.* 4447, 13 pp. (From *Metallovedenie i Obrabotka Metallov,* 1958, no. 12, Dec., p. 35-41.) Henry Brutcher, Altadena, Calif.

**11863** **Heat Treating the Stainless Steels. II.** Annealing procedures for dissolving chromium carbides. Chromium-nickel stainless steels must be cooled rapidly from annealing temperatures. ***S. W. Cole.*** *Industrial Heating,* v. 26, June 1959, p. 1146 + 6 pages.

**11864 Recent Heat Treatment Furnace Installations. Annual Survey of Developments.** Although few recent installations depart from conventional practice, several designs have considerable technical interest. *Metallurgia*, v. 59, June 1959, p. 275-294.

**11865* Heat-Treatment Control Cuts Reject Rate.** Description of code book by Brown & Sharpe Co. that simplifies selection of steel and heat-treatment for a particular component. ***Neil B. MacLaren.*** *Metalworking Production*, v. 103, no. 24, June 12, 1959, p. 1032-1033.

**11866* Mathematical Treatment of the Temperature Variation With Time in Heating and Cooling Finite Solid Cylinders, Taken as a Basis for the Heat Treatment of Large Forgings.** Establishes formulas for the temperature of the cylinder center, and surface locations. Gives numerical values for thermal conductivity and specific weight for introduction into the formulas developed. (*In German.*) Mathematische Behandlung des zeitlichen Temperaturverlaufes für die Erwärmung und Abkühlung endlicher Vollzylinder als Grundlage für die Wärmebehandlung grosser Schmiedestücke. ***Heinz Uhlitzsch.*** *Neue Hütte*, v. 4, May 1959, p. 277-287.

**11867 How to Maintain and Certify Heat Treat Furnace Controls.** Methods to clean, overhaul, and calibrate control instruments without disrupting production. ***R. M. Lady and R. G. Matthews.*** *Steel*, v. 145, July 13, 1959, p. 106-107.

***See also:*** **11949** (annealing of Ti alloys).

## METALS—MECHANICAL AND PHYSICAL PROPERTIES

**11868* The Effects of Irradiation Upon Metals.** Generation and properties of point imperfections (vacant lattice sites and imperfections) in noble metals and Cu. ***Frederick Seitz.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 3, June 1959, p. 354-367.

**11869* Activity of Cd in Mg-Cd Alloys.** ***Richard J. Borg and C. Ernest Birchenall.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 3, June 1959, p. 393-395.

**11870* Intercrystalline Fracture in Creep of Chromium and Some Chromium Alloys.** ***G. R. Wilms.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 3, June 1959, p. 411-413.

**11871* The Third Stage of Work Hardening in Aluminum Crystals Deformed at 196°K.** ***S. Sato and A. Kelly.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 3, June 1959, p. 413-420.

**11872* Recovery of Decarburized Mild Steel.** Recovery of strain hardening arising from ½% strain by subsequent heating. ***H. L. Couch and J. D. Lubahn.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 3, June 1959, p. 433-436.

**11873* Fatigue in Single Crystals of Copper.** ***M. L. Ebner and W. A. Backofen.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 3, June 1959, p. 510-520.

**11874* Solid-Solution Strengthening of Magnesium Single Crystals at Room Temperature.** Constant loading-rate and constant elongation-rate tensile tests were performed at room temperature on single-crystal binary alloys of Mg with In, Cd, Tl, Al, and Zn. ***E. D. Levine, W. F. Sheely, and R. R. Nash.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 3, June 1959, p. 521-526.

**11875* Quantitative Deformation Textures of Aluminum, Copper, Silver, and Iron Wires.** ***August Freda and B. D. Cullity.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 3, June 1959, p. 530-535.

**11876 Properties of Certain Cold-Rolled Austenitic Stainless Sheet Steels.** Physical and mechanical properties of AISI Type 301, Micro Mach, AISI Type 201, USS Tenelon, and USS 17-5 MnV steels. ***R. J. Mangone, D. B. Roach, and A. M. Hall.*** *Battelle Memorial Institute, Defense Metals Information Center, DMIC Report No.* 113, May 15, 1959, 52 pp.

**11877* Bibliography on the Effects of Hydrogen Embrittlement on Metals: 1952 to Present.** Mainly concerned with the action of H on steel and Ti. ***Patricia E. Bell, Compiler.*** 14th Ed. 19 pp. June 3, 1959. Los Alamos Scientific Laboratory of the University of California, Los Alamos, N. M. (ZTA 460 Un3.1b Ref.)

**11878 Effect of Heat Treating on Temperature vs. Impact Strength Curve.** Studies on 0.10 C - 3.6 Ni and 0.12 C - 0.97 Cr - 3.1 Ni steels. ***V. K. Tselikov.*** *Henry Brutcher Translation No.* 4390, 6 pp. (From *Metallovedenie i Obrabotka Metallov*, 1958, no. 10, Oct., p. 17-22.) Henry Brutcher, Altadena, Calif.

**11879 Study of White Layers Under Conditions of Wear Entailing Destructive Pitting.** In the study, Cr-Ni(-W) constructional steels were used. ***F. Ya. Iokheles.*** *Henry Brutcher Translation No.* 4392, 11 pp. (From *Metallovedenie i Obrabotka Metallov*, 1958, no. 10, Oct., p. 28-33.) Henry Brutcher, Altadena, Calif.

**11880 Study of Resistance of Steel to Wear by Kapron (Nylon) Thread.** Studies on 0.50, 0.80, 1.00, and 1.20% carbon steels and 1.0 C, 1.5% Cr steels. ***P. T. Basko.*** *Henry Brutcher Translation No.* 4451, 5 pp. (From *Metallovedenie i Obrabotka Metallov*, 1958, no. 12, Dec., p. 56-57.) Henry Brutcher, Altadena, Calif.

**11881 High-Temperature Properties of Multiple-Alloyed Ferrite.** Creep characteristics of ferrite alloyed with Cr, W, Mo, and Cb. ***A. M. Borzdyka and A. V. Merlina.*** *Henry Brutcher Translation No.* 4443, 14 pp. (From *Metallovedenie i Obrabotka Metallov*, 1958, no. 12, Dec., p. 10-16.) Henry Brutcher, Altadena, Calif.

**11882 Testing Spring Steel Strip for Relaxation.** ***V. Ya Zubov.*** *Henry Brutcher Translation No.* 4515, 4 pp. (From *Zavodskaya Laboratoriya*, v. 22, no. 3, 1956, p. 329-331.) Henry Brutcher, Altadena, Calif.

**11883 Evaluation of High-Temperature Properties From Rupture and Hot-Hardness Tests.** Tests on various Al alloys, including 2018 and 2024, to secure information on whether relatively short hot-hardness tests may be used in the place of rupture tests for developing new high-temperature alloys. ***Yu. A. Preobrazhenskaya.*** *Henry Brutcher Translation No.* 4594, 6 pp. (From *Zavodskaya Laboratoriya*, v. 23, no. 4, 1957, p. 485-487.) Henry Brutcher, Altadena, Calif.

**11884* On the Various Properties of High Strength Cast Iron Made by $O_2$ Blowing.** Tensile strength, volume of growth, wear resistance and effect of inoculation are a little better in cast irons made by $O_2$ blowing than in iron prepared by using steel scrap. ***Ichiro Iitaka and Kokichi Nakamura.*** *Castings Research Laboratory, Waseda University, Report No.* 9, 1958, p. 21-23.

**11885* Melt Quality and Fracture Characteristics of 85-5-5-5 Red Brass.** Gas pick-up by prolonged bubbling of water vapor in the melt with and without any deoxidizing treatment. ***Shigeo Oya and Umewo Honma.*** *Castings Research Laboratory, Waseda University, Report No.* 9, 1958, p. 25-30.

**11886 Permanent Magnet Materials.** Origin and measure of magnetization; magnetic induction; relation between magnetization and the magnetic field; definition and units; the behavior of magnetic materials; magnetization curves; factors acting on the values of magnetic properties. ***F. Anselin.*** *Cobalt*, no. 3, June 1959, p. 17-26.

**11887* Hardness and Brittleness of Compounds of Metallic Character.** Brittleness increases when the strength of interatomic bonding increases. Hardness increases in the order: silicide-nitride-carbide-boride; brittleness in the order: silicide-

boride-nitride-carbide. (*In Czech.*) Tvrdost a křehkost sloučenin kovového charakteru. ***G. V. Samsonov, V. S. Nešpor, and L. M. Chrenova.*** *Hutnické Listy*, v. 14, no. 6, June 1959, p. 484-489.

**11888* Mathematical Determination of the Internal Stresses in Ingots and Forgings.** For a quick calculation diagrams facilitate determination of temperature and stress in any part of the ingot at a given time. (*In Czech.*) Matematické určení vnitřních pnutí v ingotech a výkovcích. ***Ladislav Prášek.*** *Hutnické Listy*, v. 14, no. 6, June 1959, p. 489-493.

**11889 The Correlation of the Stress-Rupture Properties of the Nimonic Alloys.** Stress-rupture data for Nimonic 80A and Nimonic 90 were correlated by an equation based on theoretical and experimental considerations. The ability of this equation to predict stresses for rupture times up to 34,000 hr. from test data of less than 3000 hr. duration is good, being comparable to that of the Manson-Haferd parameter and better than that of other parameters in common use. ***Hans Conrad.*** *Institute of Metals, Journal*, v. 87, pt. 10, June 1959, p. 347-349.

**11890* Thermodynamics of Titanium Diboride.** Investigation of the temperature dependence of the entropy of Ti, B, $TiB_2$, and of the entropy of formation of $TiB_2$ based on the use of the experimental data of the authors on the specific heats for $TiB_2$ between 298 and 3253 K. (*In Russian.*) Termodinamika diborida titana. ***A. N. Krestovnikov and M. S. Vendrikh.*** *Izvestiia Vysshikh Uchebnykh Zavedenii, TSvetnaia Metallurgiia*, 1959, no. 2, p. 54-57.

**11891* The Fracture Mechanism in Metals With Special Regard to Brittle Fracture.** Studies on low C unalloyed steel. (*In German.*) Brottmekanismen hos metaller med speciell hänsyn till spröda brott. ***C. Schaub.*** *Jernkontorets Annaler*, v. 143, no. 4, 1959, p. 185-206.

**11892* Principles of Testing and of Evaluating the Testing Results in the Study of the Brittle-Fracture Tendency of Steel.** (*In German.*) Principer för provning och resultatbedömning vid under-sökning av ståls sprödbrottskänslighet. ***T. M. Norén.*** *Jernkontorets Annaler*, v. 143, no. 4, 1959, p. 207-230.

**11893 On Stress Interaction in Fatigue and a Cumulative Damage Rule.** The underlying physical concepts as well as the results of an investigation of the interaction of repeated stress cycles of variable amplitude in producing progressive (fatigue) damage. The materials investigated were 2024 aluminum alloy and 4340 aircraft steel. ***Alfred M. Freudenthal and Robert A. Heller.*** *Journal of the Aero/Space Sciences*, v. 26, July 1959, p. 431-442.

**11894 Magnetic Annealing in Perminvar. I. Structural Origin. II. Magnetic Properties.** I. ***R. D. Heidenreich, E. A. Nesbitt, and R. D. Burbank.*** II. ***E. A. Nesbitt and R. D. Heidenreich.*** *Journal of Applied Physics*, v. 30, July 1959, p. 995-1003.

**11895 Effect of Neutron Irradiation on Thermally and Mechanically Induced Nonequilibrium States in AuCu.** Effect of neutron irradiation on resistivity and magnetoresistivity of AuCu when subjected to various pre-irradiation thermal and mechanical treatments. ***R. L. McCollum and G. Allen.*** *Journal of Applied Physics*, v. 30, July 1959, p. 1105-1108.

**11896* Magnetic Structure of Ferromagnetics.** Magnetic Structure was investigated by means of powder patterns. Tests on single crystals of Si-Fe indicate that only certain closure domains could be nuclei of the reversed domains, but never the sub-domain (the closure domains situated near different inclusions). When the thickness of the laminar crystal of Si-Fe decreases, its magnetic structure changes. (*In French.*) Structure magnétique des corps ferromagnétiques. ***Ja. S. Šur.*** *Journal de Physique et le Radium*, v. 20, nos. 2-3, Feb.-Mar. 1959, p. 113-119.

**11897* Relationships Between the Size of the Particles and the Magnetic Properties of Iron and Cobalt Amalgams.** From the temperature dependence of remanence the distribution function of particle size for a Co amalgam in different states of aging is deduced by the method of Weil and Gruner. The consequences of particle size on the distribution function are discussed and compared with the results of the remanence method. (*In French.*) Relations entre la dimension des grains et les propriétés magnétiques des amalgames du fer et du cobalt. ***W. Henning and E. Vogt.*** *Journal de Physique et le Radium*, v. 20, nos. 2-3, Feb.-Mar. 1959, p. 277-281.

**11898* Magnetic Properties Derived From Measurements of the Electric Conductivity and of the Hall Effect of Thin Nickel Layers.** Measurements of the electrical conductivity of thin Ni films enable us to deduce the values of the ferromagnetic and paramagnetic Curie points for different thicknesses of film. The values of the spontaneous magnetization calculated by using the Cabrera formula, reach Weiss' values for bulk Ni at large film thickness, and show a sharp drop below 220 Å at room temperature. (*In French.*) Propriétés magnétiques déduites des études de conductibilité electrique et d'effet Hall des couches minces de nickel. ***A. Colombani, G. Goureaux, and P. Huet.*** *Journal de Physique et le Radium*, v. 20, nos. 2-3, Feb.-Mar. 1959, p. 303-309.

**11899 Vacuum Fatigue-Apparatus.** An apparatus is described in which it is possible to anneal specimens in vacuo and then fatigue them in vacuo or in any desired atmosphere without intermediate exposure to air. Annealing temperatures of up to 800 C are used and extension up to 1000 C is possible. ***N. J. Wadsworth.*** *Journal of Scientific Instruments*, v. 36, June 1959, p. 274-277.

**11900 Measurement of Low Values of Internal Friction at Elevated Temperatures.** An apparatus that uses electrostatic drive and frequency-modulation detection, and operates near 100 kc/s, at temperatures up to 1300 C on longitudinally resonant specimens. ***P. D. Southgate.*** *Journal of Scientific Instruments*, v. 36, June 1959, p. 284-287.

**11901 Surface Fatigue of Carbo-Nitrided Steel.** Observations supplementing previous work by these authors indicate that carbo-nitrided cases must be thick enough to withstand service-induced stresses. Otherwise, the mechanical properties of the core, which are lower, will determine the fatigue life. ***G. W. Powell, M. B. Bever, and C. F. Floe.*** *Metal Progress*, v. 75, no. 4, Apr. 1959, p. 88-90.

**11902 Low Temperature Resistance and Magneto-Resistance of Dilute Alloys of Gold With Cobalt.** ***A. N. Gerritsen.*** *Physica*, v. 25, June 1959, p. 489-502.

**11903 Optical Properties of Nickel and Tungsten and Their Interpretation According to Drude's Formula.** ***S. Roberts.*** *Physical Review*, v. 114, ser. 2, no. 1, Apr. 1, 1959, p. 104-115.

**11904 The Hardening of Copper Single Crystals by Fatigue.** Specimens were subjected to alternating stresses of such magnitude as would cause complete fatigue failures in $5 \times 10^5$ cycles. Slip striations are produced both at 78 and 293 K and plastic deformation starts in these regions if partially fatigued specimens are extended. In specimens fatigued at 293 K the material between striations begins to deform at a significantly higher stress than the maximum stress applied during fatigue and yield point phenomena are observed. Yield point phenomena are less pronounced in specimens fatigued at 78 K and additional hardening can be produced in such specimens if they are warmed after fatigue to temperatures higher than 200 K. ***T. Broom and R. K. Ham.*** *Royal Society, Proceedings*, v. 251, ser. A, May 26, 1959, p. 186-199 + 4 plates.

**11905* Microhardness, Its Importance and Measuring.** (*In Czech.*) Význam mikrotvrdosti a podmínky jejího určováni. ***J. Shon.*** *Strojírenství*, v. 9, no. 6, June 1959, p. 453-460.

**11906* Magnetostriction Constants of Face-Centered Cubic Nickel-Copper and Nickel-Cobalt Alloys.** ***Mikio Yamamoto and Takurô Nakamichi.*** *Tôhoku University, Science Reports of the Research Institutes, Ser. A. Physics, Chemistry, Metallurgy*, v. 11, no. 3, June 1959, p. 168-182.

**11907* Secular Change After Cold-Working and Annealing-Hardening of a Brass.** Measurement by hardness and the spring tests on 70/30 brass. ***Osamu Izumi and Tadatsugu Yoshiki.*** *Tôhoku University, Science Reports of the Research Institutes, Ser. A. Physics, Chemistry, Metallurgy*, v. 11, no. 3, June 1959, p. 201-209.

**11908 Hydrogen Contamination in Titanium and Titanium Alloys. V. Hydrogen Embrittlement.** Studies included detailed measurements of the effects of temperature, strain rate, and H content on H embrittlement; examination of all-alpha and all-beta alloys for susceptibility to H embrittlement; calculations of probable H solubility in alpha and beta Ti; and several other informative investigations. An embrittlement mechanism is outlined. ***D. N. Williams, F. R. Schwartzberg, and R. I. Jaffee.*** *U. S. Air Force, Wright Air Development Center, WADC Technical Report* 54-616, Feb. 1959, 94 pp. (TL507 Un3.18w Vis.)

**11909* A Study of the Nature of Fatigue Damage of Plain Carbon Steel by the Reheating Method.** Study of relations between true fatigue damage established by Sinclair and Dolan's experiment and so-called fatigue damage determined by the French method. ***Takeo Yokobori.*** *Tōhoku University, Technology Reports,* v. 23, no. 2, 1959, p. 21-31.

**11910 Heat Capacity of Copper Below 300°K, A Test of Two Calorimeter Designs.** Describes two designs of adiabatic calorimeters, in which the surroundings follow the temperature of a test specimen at all times from lowest temperature achieved by cooling up to room temperature. ***Thomas A. Sandenaw.*** *U. S. Atomic Energy Commission, LA-2307,* June 25, 1959, 19 pp. (UF767 U3La Contin.)

**11911 Uranium Alloy Development Program for OMR.** Mechanical and metallurgical properties of four potential fuel alloys for Organic Moderated Reactors. Alloys evaluated were U-3.5 Mo, U-3.5 Mo-0.5 Si, U-3.5 Mo-0.5 Al, and U-2 Zr-0.1 Al. Of these, the U-Mo and U-Mo-Si alloys were selected as the reference alloys for two OMR-type fuel elements, and are being tested in OMRE. ***W. H. Friske, H. E. Kline, and M. H. Binstock.*** *U. S. Atomic Energy Commisison, NAA-SR-3169,* May 1, 1959, 51 pp. (UF767 Un3.1na Contin.)

*See also:* **11851** (properties of Ca and Ce treated cast iron); **11949** (properties of 4% Al-4% Mn titanium alloy); **11972** (effects of dislocations on strength); **11981** (rolling texture of Hf); **11982** (kink bands in deformed crystals).

## METALS—MECHANICAL WORKING

**11912* Making Rolled Products on Vertical Roll Stands.** A study of advantages and disadvantages of using vertical roll stands with upper and lower feeds. Profiles with close tolerance are better rolled by this method. (*In Czech.*) Hranění vývalků při válcování a používání vertikálních stolic. ***Jaroslav Kláštera.*** *Hutnik (Czech),* v. 9, no. 6, June 1959, p. 199-204.

**11913 Hot-Press Forging Cuts Cost of Copper Alloy Parts.** Common types; physical, mechanical and fabricating properties of hot-press forged Cu alloys. ***A. I. Heim.*** *Iron Age,* v. 184, no. 4, July 23, 1959, p. 74-76.

**11914 Belt Grinding Titanium.** Successful grinding of Ti with abrasive belts depends on reducing its welding action to the mineral. This can be accomplished by lowering the temperature at the grinding point through adequate cooling. Successful grinding also requires controlled "fracture wear" of the abrasive grits in order to supply constant sources of cutting edges during grinding. Titanium sheet can be belt ground to close dimensional tolerances. The cost of grinding Ti is estimated to be 6 to 10 times that for stainless steel. ***Carl T. Olofson.*** *Light Metal Age,* v. 17, June 1959, p. 6-7.

**11915* Cutting Tool With Grooveless Chip Breaker.** Good tool life was obtained by rounding off the face of the tool on the side of the main and relief cutting edges according to certain parameters resulting in a rib dividing the face of tool in two different back rake angles. Economical cutting was obtained on steel using a cutting speed of 85 m/min, a feed of 0.57 mm/rev. and a depth of cut of 5 mm and less. (*In Russian.*) Rezets s beskanavochnym struzhkolomatelem. ***B. V. Vinogradov.*** *Mashinostroitel',* 1959, no. 6, June, p. 31-32.

**11916* Forging and the Space Age.** As one of the mainstays of American production, the forging industry has progressed with the times, since drop forging was introduced in 1846. Today, the industry is faced with new challenges from changing technological trends. What they are, and what they mean to forging engineers, is set forth in this article. ***J. H. Jackson and H. B. Goodwin.*** *Metal Progress,* v. 76, no. 1, July 1959, p. 65-71.

**11917* Metal Turning With the Help of Ceramic Cutting Material.** Mechanical and physical data concerning ceramic tips: 99.98% pure $Al_2O_3$; powder is 3 $\mu$ in grain size. Sintering at 1850 C resulting in the following properties: compressive strength at 20 C is 30,000 kg/cm², at 400 C 15,000 kg/cm², at 1200 C 5,000 kg/cm, bending strength 4,000 kg/cm², Vicker's hardness with 0.1 kg 2100-2500. Economical advantages in using ceramic cutting material; effects of such material on design of lathes. (*In Dutch.*) Metaaldraaien met behulp van keramisch snijmaterial. ***D. A. de Fremery.*** *Metalen,* v. 30, no. 12, June 1959, p. 182-185.

**11918* AM-350 Stainless Steel.** Turning, drilling, and tapping tests; other machining characteristics. ***P. R. Arzi, J. V. Gould, and J. Maranchik, Jr.*** *SAE Journal,* v. 67, July 1959, p. 62-63.

**11919* Measurements of Roll Force and Experience in Operation of a Full-Continuous, Seven Stand Hot Strip Finishing Mill Train.** Behavior of the roll forces at elevated rolling speeds and small strip thicknesses. Description of the apparatus used for measuring. Influence of temperature differences in the strip. Observations and measurements of the roll force carried out on strips having different thicknesses across their length. (*In German.*) Walzkraftmessungen und Betriebserfahrungen an einer vollkontinuierlichen siebengerüstigen Warmband-Fertigstrasse. ***Heinrich Lampmann and Wilhelm Völkening.*** *Stahl und Eisen,* v. 79, no. 11, May 28, 1959, p. 777-785.

**11920* The Influence of Carbon, Manganese, Chromium, Nickel and Molybdenum on the Unimpeded Spread of Steels in Hot Rolling.** (*In German.*) Der Einfluss von Kohlenstoff, Mangan, Chrom, Nickel und Molybdän auf das freie Breiten von Stählen. ***Walter Grosse and Heinrich Gottwald.*** *Stahl und Eisen,* v. 79, no. 12, June 11, 1959, p. 855-866.

**11921* The Yield Point Behavior of Rerolled Aged Sheets Made of Deep-Drawing Steel.** Skin-pass rolling. (*In German.*) Das Streckgrenzenverhalten nachgewalzter gealterter Bleche aus Tiefziehstahl. ***Werner Lueg and Paul Funke.*** *Stahl und Eisen,* v. 79, no. 14, July 9 ,1959, p. 969-976.

**11922* Measuring the Degree of Deformation in Skin-Pass Rolling.** Influence of degree of rerolling on properties of strip made of deep-drawing steel and strip and sheet for packing purposes. (*In German.*) Das Messen des Verformungsgrades beim Nachwalzen. ***Joseph Billigmann, Josef Lenze, and Dieter Schönert.*** *Stahl und Eisen,* v. 79, no. 14, July 9, 1959, p. 977-989.

**11923* Basic Designs of Draw Benches and of Their Auxiliary Equipment.** (*In German.*) Grundformen der Ziehbänke und deren Hilfseinrichtungen. ***Fritz Grah.*** *Stahl und Eisen,* v. 79, no. 14, July 9, 1959, p. 990-996.

**11924* Measuring Wear in Drawing Steel Bars With a Radioactive Drawing Tool.** Includes survey on the wear measurements carried out up to present in cold drawing. (*In German.*) Verschleissmessungen beim Ziehen von Stabstahl mit radioaktivem Ziehwerkzeug. ***Werner Lueg and Paul Funke.*** *Stahl und Eisen,* v. 79, no. 14, July 9, 1959, p. 996-1002.

**11925 System Offers Shortcut for Short Run Piercing.** Operator, guided by a color coded template, puts up to 100 holes a minute in sheet materials. Stylus is fired into a template hole, simultaneously firing the punch into the workpiece. *Steel,* v. 145, July 13, 1959, p. 112.

**11926* New Sintered Carbides for Machining.** Results concerning cutting depth, cutting speed, tool life, etc., achieved when machining with new kinds of sintered carbides having such compositions as WC-TiC-TaC-Co and WC-TiC-TaC-$Cr_3C_2$-Co. (*In Czech.*) Nove slinute karbidy na obrabeni. ***Jar.***

***Chmelik.*** *Strojírenská Výroba*, v. 7, no. 5, May 1959, p. 191-195.

**11927* Effect of Ceramic Cutting Tools Upon the Design of Machine Tools.** (*In Czech.*)Vliv keramických řezných materiálů na knostrukci obráběcích strojů. ***M. Chudárek.*** *Strojírenství*, v. 9, no. 6, June 1959, p. 432-434.

**11928* Effects of Machining Forces on Tools.** ***Robert E. McKee.*** *Tool Engineer*, v. 43, no. 1, July 1959, p. 65-72.

**11929* Industry Agrees on "Building Block" Standards.** Working together, Ford, Chrysler, General Motors, International Harvester, and the major machine tool builders developed these standards for building block construction. Their purpose is to reduce rework and retooling costs, combat premature machine tool obsolescence, and provide versatility. They will also make possible interchangeability of equipment made by one manufacturer with that of another. ***William E. Hoffman.*** *Tooling & Production*, v. 25, no. 4, July 1959, p. 35-47.

**11930* Hot Forming Steel Plate.** Considerations of material and job specifications, prior heat treatment, and welding specifications. ***M. J. Bajorek.*** *Tooling & Production*, v. 25, no. 5, Aug. 1959, p. 54-56.

**11931* Ceramic Cutting Edges Permit a Higher Capacity of the Machines.** Use of ceramic cutting tools resulted in 30% increase in machining efficiency. (*In German.*) Keramische Werkzeugschneiden erlauben höhere Maschinenleistung. ***Hans Bauer.*** *VDI Zeitschrift*, v. 101, no. 17, June 11, 1959, p. 718.

**11932 Investigation of the Temperature Deformations of Lathe Tools.** The dependence of the temperature deformation of lathe tools with VK8 and VK3 tungsten carbide tips and TsM332 ceramic tips upon the conditions of cutting and cutting-tool geometry was experimentally investigated. Advantages of using more wear-resistant tools at greater feeds and depths of cutting were established. (*In Russian.*) Issledovanie temperaturnykh deformatsii reztsov. ***E. V. Ryzhov.*** *Vestnik Mashinostroeniia*, v. 39, no. 4, Apr. 1959, p. 73-75.

***See also:*** **11723** (extrusion bibliography); **11752** (lubrication of rolling mills); **11848** (pickling of wire products); **12228** (epoxy tools).

## METALS—METALLOGRAPHY, TRANSFORMATIONS, AND STRUCTURES

**11933* Niobium Recrystallization Diagram.** Investigations showed that the optimum thermomechanical treatment condition of Nb is annealing in an interval between 1100 and 1450 C at every degree of deformation above 10%. By this treatment the fine grains and uniformity of structure of the metal is preserved. (*In Russian.*) Diagramma rekristallizatsii niobiia. ***E. M. Savitskii, V. V. Baron, and K. N. Ivanova.*** *Akademiia Nauk SSR, Doklady*, v. 126, no. 4, June 1, 1959, p. 771-773 + 1 plate.

**11934* The Effect of Torsional Strains on Self-Diffusion in Silver Single Crystals.** The diffusion rates of $Ag^{110}$ in cylindrical single crystals of 99.99% pure silver, which were twisted to a total surface strain of 0.91 during the diffusion anneal at temperatures of 700, 750, and 800 C, were measured by sectioning and counting as a function of the strain rates. Qualitative explanation for the observations based on the generation of nonequilibrium number of defects by plastic deformation. ***C. H. Lee and R. Maddin.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 3, June 1959, p. 397-401.

**11935* The Nonmetallic Constituents of Steel.** Gives the origin, modes of formation, and characteristics of nonmetallic inclusions in steel. Exogenous inclusions have their principal source in ladle refractories. Endogenous inclusions are formed mainly during cooling and freezing. The importance of inclusions is largely in their effect on mechanical properties. ***Clarence E. Sims.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 3, June 1959, p. 367-393.

**11936* Description of the Sigma Phase as a Structure With Sphere Packing.** Investigates whether a model of sphere packing permits the computation of the lattice parameters and their variation with concentration in various $\sigma$ phases. ***H. P. Stäwe.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 3, June 1959, p. 408-411.

**11937* The Constitution of Aluminum-Rich Alloys of the Aluminum-Chromium-Manganese System.** An equilibrium isotherm at 550 C is given for ternary alloys rich in Al containing 0 to 15 wt % Cr and 0 to 20 wt % Mn. ***J. W. H. Clare.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 3, June 1959, p. 429-433.

**11938* Solubility of Thorium Dihydride in Thorium Metal.** ***D. T. Peterson and D. G. Westlake.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 3, June 1959, p. 444-447.

**11939* The Origin of the Preferred Orientation in the Columnar Zone of Ingots.** Preferred orientations only develop when the preferred directions of growth reveal themselves by dendritic growth. A mechanism based on this premise is found to be in agreement with experimental data obtained on a number of metals. ***D. Walton and B. Chalmers.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 3, June 1959, p. 447-457.

**11940* The Observation of Dislocations and Other Imperfections by X-Ray Extinction Contrast.** Description of recent experimental work which shows that the Berg-Barrett method for making X-ray diffraction micrographs is capable of revealing individual undecorated dislocations in crystals of Si and LiF. ***J. B. Newkirk.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 3, June 1959, p. 483-497.

**11941* The Isothermal Transfer From Solid to Liquid in Metal Systems.** Transfer of material from solid Pb into liquid Pb-Sn alloys. ***J. M. Lommel and B. Chalmers.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 3, June 1959, p. 499-508.

**11942 Simple Method of Determining Crystal Perfection.** An optical analogy leads to a simple X-ray method of determining crystal perfection. Although furnishing only semi-quantitative information at present, this can be developed into a quantitative method. For some applications it is considered superior to existing techniques such as etch pit counts or X-ray rocking curves. ***H. K. Herglotz.*** *Electrochemical Society, Journal*, v. 106, July 1959, p. 600-605.

**11943 Etching Manual. Methods for the Preparation of Polished Sections and the Development of Structures for Metallography.** This handbook on etching written for the students of the Metallurgical Technical Institute of the University of Berlin, Germany, contains new additions concerning electrolytic polishing and etching processes, the insertion of small sections in artificial resin, chromium steels, aluminum, and titanium. (*In German.*) ATZHEFT. Verfahren zur Schliffherstellung und Gefügeentwicklung für die Metallographie. ***Angelica Schrader.*** 4th Ed. 50 pp. 1957. Gebrüder Borntraeger, Berlin. (TN690 Sch69a4)

**11944* Determination of the Origin of Non-Metallic Inclusions in Steel by Means of Radioactive Isotope $Ca^{45}$.** Use of electrolytic isolation method for nonmetallic inclusions causes dissolution of radioactive Ca and consequently the reduction of amount of active inclusions. (*In Czech.*) Určování původu nekovových vměstků v oceli pomocí radioaktivního isotopu $Ca^{45}$. ***Josef Čadek, et al.*** *Hutnické Listy*, v. 14, no. 6, June 1959, p. 478-484.

**11945* Kinetics of the First Graphitization Degree of Malleable Cast Iron.** Results of study on isothermal decomposition of ledeburitic cementite. Discussion of questions concerning formation of graphite nuclei and their growth. (*In Czech.*)

Kinetika I. stupně grafitisace temperované litiny. ***Stanislav Drápal.*** *Hutnické Listy*, v. 14, no. 6, June 1959, p. 501-507.

**11946* Influence of Cold Deformation on the Internal Structure of Austenite Grains. (Electron Microscopic Study.)** There is a complete analogy between the influence of cold deformation on subgrain etched figures and on block structure; intensive fragmentation (to 5000 Å) and block disorientation have been observed. (*In Czech.*) Vplyv studenej deformácie na vnútornú štruktúru austenitických zrn. ***Ivan Hrivňák.*** *Hutnické Listy*, v. 14, no. 6, June 1959, p. 507-511.

**11947 The Tempering of Martensite in Copper-Aluminium Alloys.** The decomposition of the martensite phase in the Cu-Al system was investigated at temperatures below that of the eutectoid transformation $\beta \rightarrow \alpha + \gamma_2$. Five alloys, containing 10.3, 11.2, 11.8, 12.05, and 12.4% Al, were obtained in the $\beta'$ condition by water-quenching from 950 C. The specimens were then tempered in a Pb bath. The microstructures of etched specimens were examined and plotted on *TTT* diagrams. Hardness measurements and X-ray diffraction photographs were used to aid the interpretation of the microstructures. ***R. G. Cope.*** *Institute of Metals, Journal*, v. 87, pt. 10, June 1959, p. 330-336.

**11948 The Solid Solubility of Lithium in Aluminium.** The maximum solid solubility of Li in Al was found, by micrographic methods, to be 4.2 wt. % at the eutectic temperature just above 600 C; the solubility falls to 1.7 wt. % at 400 C and 0.4 wt. % at 200 C. ***W. R. D. Jones and P. P. Das.*** *Institute of Metals, Journal*, v. 87, pt. 10, June 1959, p. 338-340.

**11949 Effect of Annealing Treatment on the Structure and Tensile and Creep Properties of a Commercial Titanium Alloy (4% Aluminium-4% Manganese).** ***H. W. Mead.*** *Institute of Metals, Journal*, v. 87, pt. 10, June 1959, p. p. 343-346.

**11950 The Thorium-Aluminium System.** The system was investigated over the whole range of composition by thermal, X-ray, and metallographic methods. Six intermetallic compounds occur: $Th_2Al$, $Th_3$, $Al_2$, and $TaAl_2$ are formed directly from the liquid, while ThAl, $ThAl_2$, and a compound of approximate composition $Th_2Al_5$ are formed by peritectic reactions. ***J. R. Murray.*** *Institute of Metals, Journal*, v. 87, pt. 10, June 1959, p. 349-352.

**11951 Use of Radioactive Isotopes in Investigations of the Diffusion and Thermodynamic Characteristics of Solid Solutions.** Absorption methods (the "thick layer" and the "thin layer" methods) permit determination of diffusion coefficients whereby measurements of radiation absorption are not necessary. The technique for determination of thermodynamic characteristics is based on exchange rate measurements. A non-isothermic method for determination of diffusion characteristics and techniques for measurements of the heat of dilution by the solubility to temperature ratio. ***A. A. Zhoukhovitzky.*** *International Journal of Applied Radiation and Isotopes*, v. 5, no. 3, May 1959, p. 159-174.

**11952 Methods of Studying Self-Diffusion in Metals by Means of Radioisotopes.** Deals with different methods in use at present for studying both general self-diffusion and intergranular self-diffusion. There is now a fairly wide choice of methods for general self-diffusion; that of examining sections is undoubtedly the most accurate, but in practice it is limited to measurement of diffusion coefficients greater than $10^{-11}$. For smaller values, absorption methods must be employed. (*In French.*) Méthodes d'étude de l'autodiffusion dans les métaux à l'aide des radioisotopes. ***Claude Levmonie and Paul Lacombe.*** *International Journal of Applied Radiation and Isotopes*, v. 5, no. 3, May 1959, p. 175-196.

**11953* Effects of Carbon Content on th Phase Composition and Some Characteristics of Low-Alloy Cast High-Speed Steel.** (*In Russian.*) Vliianie soderzhaniia ugleroda na sostav faz i nekotorve kharakteristiki malolegirovannoĭ litoĭ bystrorezhushcheĭ stali. ***N. A. Erofeer.*** *Izvestiia Vysshikh Uchebnykh Zavedenīĭ, Chernaia Metallurgiia*, 1959, no. 4, Apr., p. 79-83.

**11954* Magnetic Study at a Low Temperature of Cu-Co Precipitates: Effect of Mechanical and Thermal Treatments on the Precipitates.** A magnetic method is used to study the texture of cobalt precipitates in C. Cold drawing always causes rupture of the precipitated grains. Fast quenching (in an extremely rapid current of $H_2$) favors precipitates with particles of less than 40 Å, whose size does not significantly increase with heat treatment. (*In French.*) Étude magnétique a basse température des Cu-Co: Effet des traitements mécaniques et thermiques sur les précipitations. ***L. Weil.*** *Journal de Physique et le Radium*, v. 20, nos. 2-3, Feb.-Mar. 1959, p. 282-285.

**11955 Diffusion of Copper in Cadmium Sulfide Crystals.** ***Raymond L. Clarke.*** *Journal of Applied Physics*, v. 30, July 1959, p. 957-960.

**11956 X-Ray Method for the Differentiation of $\{111\}$ Surfaces in $A^{III}B^{V}$ Semiconducting Compounds.** X-ray measurements of a series of $\{111\}$ reflections from opposite sides of an InAs single crystal were made and related to the etching characteristics of these surfaces. ***E. P. Warekois and P. H. Metzger.*** *Journal of Applied Physics*, v. 30, July 1959, p. 960-962.

**11957 Synthesis of a (110) [001] Type Torque Curve in Silicon Iron.** The orientations and sizes of all the grains in a polycrystalline disk specimen of high-purity 3.25% Si Fe were measured to determine a calculated magnetic torque curve and the texture of the specimen. The torque results agree with the experimentally determined values. The curves approximate a (110) [001] single crystal torque curve, which is reduced about 75%, and thus indicate a possible texture consisting of about 25% (110) [001] and 75% random. ***C. G. Dunn and J. L. Walter.*** *Journal of Applied Physics*, v. 30, July 1959, p. 1067-1072.

**11958 Electron Metallographic Evidence of Diffusion of Hydrogen Through Tin Plate Containers.** Electron metallographs evidenced rupture and blistering of the exterior tin surface of containers which had failed prematurely due to excessive H formation by corrosion processes within the container when packed with grapefruit juice. The enlargement of grain boundaries of the base steel of tin plate due to H diffusion is illustrated. ***Elma Lanterman.*** *Journal of Applied Physics*, v. 30, July 1959, p. 1084-1086.

**11959 Electron Mirror Microscopy of Magnetic Stray Fields on Grain Boundaries.** Experimental evidence is presented that electron mirror microscopy is particularly well suited for direct visual observation of magnetic stray fields at grain boundaries in magnetic materials. Silicon-iron disks were used as specimens. ***Ludwig Mayer.*** *Journal of Applied Physics*, v. 30, July 1959, p. 1101-1104.

**11960 The Nature of Martensitic Transformations.** ***G. V. Kurdjumov.*** *Journal of Metals*, v. 11, July 1959, p. 449-453.

**11961* How to Avoid Trouble With Type 431 Stainless.** Effect of delta ferrite; ferrite-free steel; removing segregation austenite; machining characteristics; heat treating characteristics; N pickup; quenching procedures. ***C. C. Angstadt.*** *Metal Progress*, v. 75, no. 6, June 1959, p. 86-91.

**11962* The Gradient Furnace—a Versatile Research Tool.** Furnace muffle is heated at one end. This furnace shortens considerably the time normally necessary to determine grain coarsening, austenitizing and tempering temperatures. It can also be used for isothermal transformation, solution treating and aging studies. ***Andrew Feduska and Paul E. Busby.*** *Metal Progress*, v. 75, no. 6, June 1959, p. 92-96.

**11963* Sulphur Printing—a New Evaluation.** Normally quite accurate in outlining sulphide distribution in steels, S prints can be adversely affected by tiny electrical currents generated between inclusion and base metal. The misleading indications which occur are explained by corrosion theory. ***S. Ramachandran and W. G. Renshaw.*** *Metal Progress*, v. 76, no. 1, July 1959, p. 101-104.

**11964 Growth of Metal Single Crystals.** *National Bureau of Standards, Technical News Bulletin*, v. 43, July 1959, p. 136.

**11965* A Contribution to the Problem of Carbide Streak Formation in Antifriction-Bearing Steel.** Stresses in antifriction bearings; requirements of the material; development and distribution of carbides in antifriction-bearing steel. In-

fluence of deformation temperature, structure of casting, degree of deformation, heating before and cooling after deformation. (*In German.*) Beitrag zur Frage der Karbidzeiligkeit bei Wälzlagerstahl. ***Hans Joachim Eckstein.*** *Neue Hütte*, v. 4, May 1959, p. 304-311.

**11966 The Martensite Transformation in Thin Foils of Iron-Nitrogen Alloys.** Martensite consists of very thin fiber crystals which are twin orientated. The difference in orientation relationship is explained by the fact that in thin foils the transformation mechanism is less hampered by the surrounding parent lattice than in bulk materials. A simple transformation mechanism is deduced consisting of a pure distortion and a half twin shear. ***W. Pitsch.*** *Philosophical Magazine*, v. 4, ser. 8, May 1959, p. 577-584 + 2 plates.

**11967 Observations of Dislocations and Precipitates in Aluminium Alloys.** Electron transmission micrographs of quenched Al alloys show that the specimens contain many complex dislocations and large dislocation loops with diameters up to 2000 Å. The observations are discussed in relation to the hardening effect of quenching and of precipitation after aging. ***G. Thomas.*** *Philosophical Magazine*, v. 4, ser. 8, May 1959, p. 606-611 + 6 plates.

**11968 The Atomic Diffusion of Chromium in the Titanium-Chromium System.** Diffusion rates of Cr in the body-centered cubic phase of the Ti-Cr system were measured by an autoradiographic tracer technique using the radioactive isotope $^{51}Cr$. The activation energy for tracer diffusion at zero solute concentration is very much lower than that expected for self-diffusion in pure Ti. ***A. J. Mortlock and D. H. Tomlin.*** *Philosophical Magazine*, v. 4, ser. 8, May 1959, p. 628-643.

**11969 Growth of Large Diameter Silicon and Germanium Crystals by the Teal-Little Method.** Equipment and techniques used to grow 6-in. dia. crystals; effect of spin, radiation, and mode of heating on crystal growth from a melt. ***W. R. Runyan.*** *Review of Scientific Instruments*, v. 30, July 1959, p. 535-540.

**11970 Preparation of Diffusion Couples by Cathodic Sputtering.** Apparatus and techniques are described for preparing metal diffusion couples by cleaning the sample surface and depositing an isotope layer by cathodic sputtering. ***Rolf Weil, Steven J. Rothman, and Lowell T. Lloyd.*** *Review of Scientific Instruments*, v. 30, July 1959, p. 541-543.

**11971 Single-Crystal Automatic Neutron Diffractometer.** An automatic neutron diffraction system for measuring the intensities of all accessible reflections in a zone is described. Crystal and counter setting information is supplied to the instrument on five-channel punched paper tape. The angular settings are measured by means of analog-to-digital converters. All angle information is printed out digitally, together with the diffraction intensity information. ***E. Prince and S. C. Abrahams.*** *Review of Scientific Instruments*, v. 30, July 1959, p. 581-585.

**11972* Dislocations and Mechanical Strength of Metals and Alloys.** A simple calculation of the material resistance makes it possible to determine that the stress necessary to produce a plastic deformation of a metal represented by a regular crystalline lattice is ten thousand times higher than the stress that can be determined experimentally. This contradiction is solved by the assumption that the metals contain linear defects or dislocations. This theory is applied to problems of mechanical strength. (*In French.*) Dislocations et ténacité des métaux et alliages. ***Adrien Saulnier.*** *Revue de l'Aluminium*, v. 36, no. 264, Apr. 1959, p. 435-444.

**11973* Grain Behaviour in 70/30 Brass Plate Heat-Treated Rapidly at High Temperatures.** Applicability of rapid heating for controlling the grain size. Effects of impurities, rolling reduction, and ready-to-finish grain size were reduced much more than in the case of the ordinary batch-annealing method at lower temperatures. Material slightly cold-rolled showed a grain growth although no recrystallization could be observed. ***Osamu Izumi and Tadatsugu Yoshiki.*** *Tôhoku University, Science Reports of the Research Institutes, Ser. A. Physics, Chemistry, Metallurgy*, v. 11, no. 3, June 1959, p. 161-167.

**11974 An Isothermal Transformation Study of the Beta Phase Decomposition in a Hypo-Eutectoid Copper-Indium Alloy.** . . . 69.30 wt-% Cu and 30.65 wt-% In alloy. ***James A. Street.*** *U. S. Air Force, Wright Air Development Center, WADC Technical Report* 59-58, Feb. 1959, 54 pp. (T1507 Un3.18w Vis.)

**11975 Lattice Defects in Transition Metal Hydrides.** Method of determining the type of defect present in non-stoichiometric transition metal hydrides. ***G. G. Libowitz.*** *U. S. Atomic Energy Commission, NAA-SR-3452*, June 1, 1959, 14 pp. (UF767 Un3.1na Contin.)

**11976 Tabulation, Bibliography, and Structure of Binary Intermetallic Compounds. V. Compounds of Aluminum and Indium.** ***A. E. Ray, J. A. Kingston, and J. F. Smith.*** *U. S. Atomic Energy Commission, ISC-1155*, Apr. 23, 1959, 41 pp. (UF767 Un3.1is Contin.)

**11977* A Contribution to the Study of the Structure of the Vanadium-Boron System.** Studies on pressure-sintered, normal-sintered, and molten specimens. Measurements of melting points, analysis of microstructure, and X-ray-investigations were carried out to give a preliminary constitutional diagram. The compounds $V_3B_2$, VB, $V_3B_4$, and $VB_2$ were observed. Their melting points and hardness are relatively high. (*In German.*) Beitrag zum Aufbau des Systems Vanadin-Bor. ***Hans Nowotny, Friedrich Benesovsky, and Richard Kieffer.*** *Zeitschrift für Metallkunde*, v. 50, May 1959, p. 258-261.

**11978* The Indium-Cadmium Phase Diagram.** The system In-Cd was investigated by thermal, microscopic, dilatometric, and X-ray analysis. A peritectic reaction was found, which leads to the $InCd_3$ phase. The solubility of Cd in In, and transformation of the tetragonal face-centered In lattice into a cubic face-centered lattice between 4 and 5 at. % Cd were determined. (*In German.*) Das Zustandsbild Indium-Kadmium. ***Theo Heumann and Bruno Predel.*** *Zeitschrift für Metallkunde*, v. 50, June 1959, p. 309-314.

**11979* Investigations of Zinc Recrystallization. I. Primary Recrystallization.** Proves that recrystallization begins in high-purity Zn at room temperature immediately after plastic deformation; shows, however, almost no progress at longer aging. Recrystallization diagrams are given. Commercial Zn (spelter) shows, due to impurities, an essentially different recrystallization behavior. (*In German.*) Untersuchungen über die Rekristallisation von Zink. I. Primäre Rekristallisation. ***Heinz Borchers and Rainer Schwarzwälder.*** *Zeitschrift für Metallkunde*, v. 50, June 1959, p. 315-323.

**11980* Growth Kinematics of Tin Crystals.** Microcinematographic analysis of growth phenomena of electrolytically precipitating Sn crystals; periodicity of the growth rythm; intergrowth of the growing crystals bodies; change of the dentrites and hemidendrites into crystal bipyramids. (*In German.*) Wachstumskinematik von Zinnkristallen. ***Ilias Anastasiadis.*** *Zeitschrift für Metallkunde*, v. 50, June 1959, p. 328-338.

**11981* The Rolling Texture and the Recrystallization Texture of Hafnium.** The preferred orientation of cold-rolled Hf (99.53%) was determined. In the stereographic (0001)-diagram the most intense area forms an elliptic ring around the center of the pole figure, showing maximal intensity in the NR-QR direction in a distance of about 25° from the center (normal direction NR). The [1010]-direction is parallel to the rolling direction (WR). After recrystallization, a mixed texture was found: the still existing rolling texture was superimposed by a (0001) [1120]-texture, rotated 25° around the rolling direction. (*In German.*) Die Walz- und Rekristallisationstextur von Hafnium. ***Herbert Müller.*** *Zeitschrift für Metallkunde*, v. 50, June 1959, p. 346-350.

**11982* A Contribution to the Theory of the Formation of the S-Shaped Kink-Bands on Plastically Deformed Metal Crystals. II. Orientation, Stability and Mode of Development of the Kink Band.** The influence of temperature and rate of deformation, orientation of the stress axis, and mode of deformation on formation and size of kink-bands can, to a large extent, be understood with a kink-band model given in this paper. (*In German.*) Zur Theorie der Bildung s-förmiger Knickbänder auf plastisch verformten Metallkristallen. II. Verset-

zungsanordnung, Stabilität und Entwicklungsverlauf des Knickbandes. ***Hartwig Müller.*** *Zeitschrift für Metallkunde*, v. 50, June 1959, p. 351-363.

*See also:* **11231** (dislocations in MgO); **11894** (structure of Perminvar).

## METALS—POWDER

**11983 Application of Dispersion Hardening to Cobalt.** Cobalt with 1.0 vol. % $Cr_2O_3$ showed only 4% of the total creep elongation of pure Co after 250 hours at 500 C and 12,000 psi (8.4 kg/mm²) stress. Oxide particle size was found to be an important factor in obtaining oxide-dispersion strengthening. Co-Cr-base powder-metallurgy alloys containing intrinsic $Cr_2O_3$ dispersions exhibited improved tensile and creep properties over those of pure Co. ***Earl F. Adkins and Robert I. Jaffee.*** *Cobalt*, no. 3, June 1959, p. 27-30.

**11984* Sintered Intermetallic Compound NiAl as High Temperature Material. I.** Density, porosity, volume change, hardness, and the expansion coefficient were measured and the microscopic structure examined. ***Yûnoshin Imai and Masuji Kumazawa.*** *Tôhoku University, Science Reports of the Research Institutes, Ser. A. Physics, Chemistry, Metallurgy*, v. 11, no. 3, June 1959, p. 210-219.

**11985* The Pressing of Powder Metals.** Study of the effects of pressing time on density of briquettes, of the elastic aftereffects in pressed powders, of effects of successive pressing processes on strength of the sinters, and of distribution of the stresses during pressing. The metals studied were Cu, W, and Fe. (*In Russian.*) O pressovanii metallicheskikh poroshkov. ***S. Ia. Plotkin and G. V. Samsonov.*** *Vestnik Mashinostroeniia*, v. 39, no. 5, May 1959, p. 53-56.

*See also:* **11977** (structure of the V-B system).

## NONDESTRUCTIVE TESTING AND QUALITY CONTROL

**11986* Non-Destructive Testing of MTR-Type Fuel Elements by Autoradiography.** A critical survey of methods employed for the testing of MRT-type fuel elements and the measuring technique of the Al-clad thickness by film autoradiography, using the $\beta$-component of the radiation emitted by Al-17% U plates. (*In Italian.*) Controllo non distruttivo degli elementi combustibili tipo MTR mediante autoradiografia. ***G. Lancellotti and M. Robba.*** *Alluminio*, v. 28, no. 6, June 1959, p. 269-277.

**11987 Automatic Measurement of Quality in Process Plants. Proceedings of a Conference Held at Swansea September 23-26, 1957.** These 25 papers of the Conference provide a valuable and objective survey of various techniques available for quality control in process plants. 320 pp. 1958. Academic Press, New York. (TP155.5 So13a)

**11988 Estimation of Amount of Hairline Cracks in Heats of Steel.** Use of magnetic flaw detector and results. ***G. S. Chernyak.*** *Henry Brutcher Translation No.* 4595, 9 pp. (From *Zavodskaya Laboratoriya*, v. 22, no. 10, 1956, p. 1182-1185.) Henry Brutcher Altadena, Calif.

**11989* Let's Take the Guesswork Out of Inspection.** Discussion of a simple, practical method of drawing the line between acceptance and rejection of parts that border perilously close on tolerance limits. ***Jack S. Gantt.*** *Metalworking Production*, v. 103, no. 24, June 12, 1959, p. 1035-1040.

**11990* Non-Destructive Inspection of Rockwool Insulating Material.** ***Ross W. Buchanan and Fred P. Venditti.*** *Nondestructive Testing*, v. 17, no. 4, July-Aug. 1959, p. 225-226.

**11991* Progress in Technology and Equipment for Eddy Current Inspection.** ***H. L. Garbarino and H. N. Nerwin.*** *Nondestructive Testing*, v. 17, no. 4, July-Aug. 1959, p. 229-234.

**11992 Determining Cladding Thickness of Fuel Elements by X-Rays.** X-ray fluorescent techniques, U L-series technique, U K-series technique, scanning and Compton scattering technique are discussed. ***Beverley James Lowe, Payson D. Sierer, Jr., and Robert B. Ogilvie.*** *Nucleonics*, v. 17, July 1959, p. 70 + 1 page.

**11993* Ultrasonic Testing of Products of the Iron and Steel Industry.** Essential features of ultrasonic testing. Examples for their application to forged pieces, heavy plates, sheets as well as seamless and welded tubes. Limitations and difficulties encountered in the interpretation of the ultrasonic test results. (*In German.*) Ultraschallprüfung von Erzeugnissen der Eisen schaffenden Industrie in der laufenden Fertigung. ***Hermann-Josef Kopineck, Hans Krächter, and Werner Rauterkus.*** *Stahl und Eisen*, v. 79, no. 11, May 28, 1959, p. 786-797.

**11994* "Random-Check-Delay" or "Work Sampling" Study and Its Application.** The most important prerequisites to its application: as regards human relations, sufficient number and strength of evidence of the observations, reliability and clear delimitation of the observations. Relationship with the performance degree and recreation time. Examples of application to assess the times of workmen, operating means and idle times. (*In German.*) Die "Multimoment"-Aufnahme und ihre betriebswirtschaftliche Anwendung. ***Ludwig Weber.*** *Stahl und Eisen*, v. 79, no. 11, May 28, 1959, p. 802-811.

**11995* Reliability Engineering, Today and Tomorrow.** Reliability engineering is essentially a predictive science. It is concerned with the prediction of how long equipment will last in a specific environment. It also provides techniques for developing products with a designated life span, and for improving products to meet higher requirements. Materials, production processes, and quality control measures must also be considered when the proposed product reaches manufacturing stage. ***Kenneth E. Cochran.*** *Tooling & Production*, v. 25, no. 5, Aug. 1959, p. 37-40.

**11996* Quality Pre-Control.** A new development in optical projection results in improved performance of optical comparator for keeping production within allowable tolerance values. ***E. Willard Pennington.*** *Tooling & Production*, v. 25, no. 5, Aug. 1959, p. 62-63.

## NUCLEAR PHYSICS, NUCLEONICS, AND RADIATION

**11997* Fission of $Th^{232}$ Nuclei by Negative $\mu$- and $\pi$-Mesons.** Investigations showed that the catalytic fission of Th by $\mu$-mesons by means of radiationless capture is not very probable. About 300 captures of $\mu$-mesons by Th atoms are necessary for one catalytic fission to take place. (*In Russian.*) Delenie iader $Th^{232}$ otritsatel'nymi $\mu$- i $\pi$-mezonami. ***M. G. Petrashku and A. K. Mikhul.*** *Akademiia Nauk SSR, Doklady*, v. 126, no. 4, June 1, 1959, p. 752-754.

**11998* A Contribution to the Covariant Study of the High Energy Nucleon-Nucleon Diffusion.** The nucleon-nucleon diffusion was examined with the help of the Bethe and Salpeter equation in order to determine if it is possible, by means of an approach including relativistic corrections, to justify results derived from proton-proton diffusion tests conducted in an energy domain up to 300 MeV. (*In French.*) Contribution a l'étude covariante de la diffusion nucléon-nucléon a haute énergie. ***Michel Gourdin.*** *Annales de Physique*, v. 4, ser. 13, nos. 5-6, May-June 1959, p. 595-641.

**11999* A Contribution to the Study of the Part Played by Eccentric Forces in the Nuclear Structure.** An examination of different aspects of the role of eccentric forces in the structure of the atom nuclei and of the possible relationships between these forces and an investigation into the problems of beta-radioactivity and their implications concerning these forces,

and into the origin of the spin-orbit forces. (*In French.*) Contribution a l'étude du role des forces non centrales dans la structure nucléaire. ***Bernard Jancovici.*** *Annales de Physique*, v. 4, ser. 13, nos. 5-6, May-June 1959, p. 689-744.

**12000 The Applications of the Thermonuclear Explosion.** A study of the different uses that can be derived from the thermonuclear explosion and from the geothermal and solar energies resulting from it: feeding central heating plants or hydroelectric power plants, elimination of freezing along rivers, raising of temperature in winter, irrigation of immense desert regions, etc. In addition to the possible peaceful use of this energy, a study of its use in war is made. (*In French.*) Les applications de l'explosion thermonucléaire. ***Camille Rougeron.*** 307 pp. 1956. Berger-Levrault, Paris. (UF767 R75a)

**12001* Contributions to the Decay of $Tb^{160}$ to $Dy^{160}$.** The spectra of conversion electrons and photoelectrons have been reinvestigated with high resolution and accuracy. Four new transitions have been found. Their intensities are given as well as their multipolarities. It was possible to decide between two different decay schemes that have been proposed earlier. The possible existence of an odd parity vibrational band ($K = 0$) is discussed. ***G. Bäckström, J. Lindskog, O. Bergman, E. Bashandy, and A. Bäcklin.*** *Arkiv för Fysik*, v. 15, no. 2, 1959, p. 121-129.

**12002* On the Theory Underlying Diffusion Measurements With Pulsed Neutron Sources.** Starting from the time-dependent Boltzmann equation some problems relating to measurements with pulsed neutron sources in small geometries are investigated. It is shown that the commonly used formula for the time constant of the fundamental mode of the neutron distribution is only approximate. As a consequence all diffusion cooling coefficients measured up to now are too small by 5 to 30%. ***N. G. Sjöstrand.*** *Arkiv för Fysik*, v. 15, no. 2, 1959, p. 147-158.

**12003* An Approximate Method of Homogenizing a Heterogeneous Reactor.** The general principle of homogenizing, using the functional coefficient of effectiveness, is discussed. It is shown that on calculation of heterogeneous reactors the use of effective sections of capture and fission, obtained by way of neutralization on the space neutron spectrum in an infinite lattice, results in an error of the coefficient of effectiveness, which is proportional to the Laplacian of the reactor $\pi^2$. The obtained diffusion coefficient depends on the direction in the lattice. (*In Russian.*) O priblizhennom metode gomogenizatsii geterogennogo reaktora. ***V. V. Smelov.*** *Atomnaia Energiia*, v. 6, no. 5, May 1959, p. 546-555.

**12004* Global Symmetry and Isotopic Spin Conservation in Nonleptonic Hyperon Decays.** The possibility of the existence of an universal *V-A*-interaction and of a complete symmetry on non-lepton decay is discussed. The deflection from the expected symmetry, observed on real decays, are explained by effects caused by the mesonic structure of hyperons. The new isotopic spin, which is equivalent to ½ for all barvons and to 0 or 1 for *K*-mesons, is determined in a close connection with the idea of a complete symmetry. (*In Russian.*) Polnaya simmetriya i sokhranenive izotopicheskogo spina pri neleptonnom raspadve giperonov. ***Gyo Takeda and Masaaki Kato.*** *Atomnaia Energiia*, v. 6, no. 5, May 1959, p. 556-562.

**12005* An Experimental Test of the Behavior of Charged Particles in an Adiabatic Trap.** The motion of the beta-particles of tritium in an adiabatic trap was examined. Under determined conditions the number of collisions of the beta-particles from a region with a strong magnetic field exceeds $10^7$. The relationship between life of the beta-particles in the trap and gas pressure, configuration of the magnetic field, and degree of its uniformity was determined. (*In Russian.*) Eksperimental'naia proverka povedeniia zariazhennykh chastits v adiabaticheskoĭ lovushke. ***S. N. Rodionov.*** *Atomnaia Energiia*, v. 6, no. 6, June 1959, p. 623-629.

**12006 Spins of Excited States of $Os^{188}$.** Seven excited states of $Os^{188}$ populated through the beta decay of $Re^{188}$ have been studied by gamma-gamma angular correlation experiments. Some attenuation occurred in the correlations involving the 155-kev gamma ray. The 631-137 correlation data in $Os^{188}$ was found to fit an attenuated 2-2-0 function with the first transition 99% *E*2 and δ-ve. This result supports the established decay scheme for this nucleus. ***W. J. King and M. W. Johns.*** *Canadian Journal of Physics*, v. 37, June 1959, p. 755-774.

**12007* The Occurrence of $(n,3n)$ Reactions in a Nuclear Reactor.** The reactions $Bi^{209}(n,3n)Bi^{207}$ and $Au^{197}(n,3n)Au^{195}$ have been observed to occur in NRX, a thermal neutron reactor. Competing reactions leading from $Bi^{209}$ or $Au^{197}$ to the same products have been shown to be negligible. ***T. A. Eastwood and J. C. Roy.*** *Canadian Journal of Physics*, v. 37, July 1959, p. 815-826.

**12008 European Atomic Fuels Grow.** Predicts a West European demand for natural U metal reaching 5000 tons a year by 1965. Data are presented in a map and table. *Chemical and Engineering News*, v. 37, no. 30, July 27, 1959, p. 64-69.

**12009* Coolant Instrumentation for Pressurized Water Reactor Power Plants. *J. J. Lihota and C. B. Hoppa.*** *Communication and Electronics*, 1959, no. 42, May, p. 131-136.

**12010* Computational and Experimental Techniques in Nuclear Reactor Design.** Discussion of nuclear design only, rather than engineering design. ***W. F. Witzig, M. R. Stuart, and L. O. Herwig.*** *Communication and Electronics*, 1959, no. 42, May, p. 155-163.

**12011* Problems in the Interpretation of Cosmic Ray Nuclear Interactions. *Kurt Sitte.*** *Czechoslovak Journal of Physics*, v. 9, no. 3, 1959, p. 271-287.

**12012* The Meson Decay of Light Hyperfragments.** The binding energies of five types of light hyperfragments containing one hyperon instead of one neutron, were measured. (*In Russian.*) Mezonnye raspady legkikh giperfragmentov. ***Zdeněk Korbel and Ladislav Rob.*** *Czechoslovak Journal of Physics*, v. 9, no. 3, 1959, p. 288-290.

**12013* The Influence of Fringing on Betatron Oscillations in an Accelerator With a Sectioned Magnet. II.** (*In Russian.*) Vliianie kraevykh polei na betatronnye kolebaniia v uskoritele s razreznym magnitom. II. ***Jiří Teichman.*** *Czechoslovak Journal of Physics*, v. 9, no. 3, 1959, p. 388-394.

**12014 Seaworthy Reactor.** A pressurized-water reactor, a boiling-water reactor, an organic liquid moderated reactor, cooling systems, heavy water moderation, and pressure tube construction are discussed. ***H. F. Atkins.*** *Engineering*, v. 187, June 19, 1959, p. 792-795.

**12015 The University of Florida Training Reactor.** A 10 KW water-cooled and moderated, graphite-reflected reactor with flat, Al-clad, fuel plates of U-Al alloy. ***James M. Duncan.*** *Florida. University. Engineering and Industrial Experiment Station. Leaflet Series No.* 107, Apr. 1959, 19 pp. (TA1 F66L Contin.)

**12016* Lorentz-Invariant Gravitation Theory.** Field equations, the energy-impulse-tensor, the relation with the substance-free Einstein-equations, the source of the gravitation field, other fields in the gravitation field, classic particles in the gravitation field, constant fields, variation of calibration and special effects are discussed. (*In German.*) Lorentz-invariante Gravitationstheorien. ***Walter Thirring.*** *Fortschritte der Physik*, v. 7, no. 2, 1959, p. 79-101.

**12017* Hazards and Safety Measures Related to Nuclear-Powered Merchant Ships.** An annotated bibliography of declassified literature. ***M. K. White, compiler.*** 96 pp. Mar. 1959. Arthur D. Little, Inc., Cambridge, Mass. (ZVM312 Un3.1h Ref.)

**12018* Photo-Mesons From Polarized Nucleons.** The angular distribution of mesons produced by polarized photons is studied, taking into account the spin states of the nucleon. ***Alladi Ramakrishnan, S. K. Srinivasan, N. R. Ranganathan, and K. Venkatesan.*** *Indian Academy of Sciences, Proceedings*, v. 49, sec. A, no. 5, May 1959, p. 302-305.

**12019* Nuclear Layers and Disintegration Energies of the Beta-Emitters.** The plots of $Q\beta$ versus the number of protons or neutrons published in the first paper on this subject, in *Journal de Physique et le Radium* of April 1958, have been revised with the help of the new Table of Isotopes—*Review of Modern Physics*, April 1958. There are still discontinuities in

the two kinds of plots which do not coincide. (*In French.*) Couches nucléaires et énergies de désintégration des émetteurs β. ***Maurice-E. Nahmias.*** *Journal de Physique et le Radium*, v. 20, no. 4, Apr. 1959, p. 482-487.

**12020* Beta-Gamma Angular Correlation With the Resonance Energy.** The author studies the conditions for the success of an experiment of beta-gamma angular correlation, with resonance fluorescence of the gamma-ray. Additions are made to previous calculations of other authors. Emphasis is put on the calculation of quantities directly accessible to experiment. (*In French.*) Correlation angulaire bêta-gamma a l'énergie de résonance. ***Maurice Spighel.*** *Journal de Physique et le Radium*, v. 20, no. 4, Apr. 1959, p. 487-491.

**12021* Magnetic Confinement of Thermonuclear Reactions.** Some of the difficulties inherent to the large-scale release of fusion energy are discussed. In particular, the problem of containing a thermonuclear plasma is investigated. A method of doubling the effectiveness of magnetic confinement is devised. (*In French.*) Confinement magnétique des réactions thermonucléaires. ***A. V. J. Martin and F. J. Young.*** *Journal de Physique et le Radium, (Suppl.)*, v. 20, no. 4, Apr. 1959, p. 1A-4A.

**12022* Review of Progress With Large Nuclear Power Stations in U.S.A.** Shippingport, Yankee, and Indian Point reactors are summarized. ***J. R. Finniecome.*** *Mechanical World and Engineering Record*, v. 139, June 1959, p. 251-255.

**12023* Toolroom Methods Produce Reactor Component.** Problems and methods of production of the tube nest for the central core of the Dounreay fast reactor made by Silcoms. ***E. C. Hall.*** *Metalworking Production*, v. 103, no. 23, June 5, 1959, p. 979-983.

**12024* On a Symmetry in Weak Interactions.** Nuclear beta decay experiments require a (V - 1.2 A) interaction in the charge-exchange order for the baryon and lepton currents separately. ***A. Gamba, R. E. Marshak, and S. Okubo.*** *National Academy of Sciences, Proceedings*, v. 45, June 1959, p. 881-885.

**12025 A Natural Uranium-Graphite Subcritical Reactor System for Education and Research.** Description and experimental measurements. IBM 650 computer programs for effective size, diffusion length, and material buckling calculations. ***A. L. Babb, L. Grimsrud, and S. Tashiro.*** 33 pp. 1959. Engineering Experiment Station, University of Washington, Seattle. (QC786 B12n Over.)

**12026* The Properties of the Light and Heavy Mesons.** A study of $\mu$-, $\pi$- and K-mesons, modern methods of detection: the cloud chamber and the bubble chamber, scintillation counter; life and decay scheme, mesonic atoms, fusion, and heavy mesons. (*In German.*) Die Eigenschaften der leichten und schweren Mesonen. ***W. Gentner.*** *Naturwissenschaften*, v. 46, no. 9, May 1959, p. 283-289.

**12027* The Harwell Neutron Project.** Summary of characteristics. ***M. J. Poole.*** *New Scientist*, v. 5, May 21, 1959, p. 1142-1145.

**12028 Determination of Cladding Thicknesses of Nuclear Fuel Elements by X-Rays.** ***Paul Lublin.*** *Norelco Reporter*, v. 6, no. 3, May-June 1959, p. 57-59.

**12029* 1959 Nuclear Data Tables.** This successor to the New Nuclear Data Cumulations represents a change wherein the yearbook is devoted to information which has been systematized according to some nuclear property. ***K. Way, editor.*** 151 pp. 1959. National Academy of Sciences—National Research Council, Washington, D. C. (QC173 Un3.1nu Ref.)

**12030* The Response to High-Energy Gamma Rays of a NaI (Tl) Scintillation Spectrometer.** Measurements were performed with cylindric lead collimators of diameters ranging from 2.5 to 17 cm. The variation of the shape of the response function with photon energy is shown to be rather small, thus permitting interpolation and extrapolation towards higher energy. The inverse matrix was computed and used to compare an experimental bremsstrahlung spectrum from a 30 MeV synchrotron with a theoretical one. ***J. Kockum and N. Starfelt.*** *Nuclear Instruments and Methods*, v. 4, Apr. 1959, p. 171-180.

**12031 Theory of Time Resolution in Scintillation Counters.** Four methods of handling the output pulse current of a scintillation counter, for extracting time information, have been theoretically compared. ***E. Gatti and V. Svelto.*** *Nuclear Instruments and Methods*, v. 4, May 1959, p. 189-201.

**12032* The $Y^{89}$ (n, $\gamma$) $Y^{90}$ Reaction.** The thermal neutron capture $\gamma$ rays from the $Y^{89}$(n, $\gamma$)$Y^{90}$ reaction were investigated in the energy region between 0.18 and 7.0 MeV with a pair spectrometer, a flat crystal spectrometer, and an angular correlation arrangement using two sodium iodide crystals. ***G. A. Bartholomew, P. J. Campion, J. W. Knowles, and G. Manning.*** *Nuclear Physics*, v. 10, no. 5, Apr. 1959, p. 590-605.

**12033* Energy Levels of Light Nuclei. VI.** The book presents experimental information on the energy levels of the nuclei from $He^5$ to $Ne^{24}$. Each nucleus is represented by a diagram and a table, in which the known energy levels are indicated, together with the nuclear reactions in which they are involved. ***F. Ajzenberg-Selove and T. Lauritsen.*** *Nuclear Physics*, v. 11, no. 1, May 1959, p. 1-340.

**12034* Doublet Splittings in Nuclei and the Strongly Correlated Nuclear Wave Functions.** The nucleon-nucleus *LS* coupling is calculated using the Brueckner type of theory and the strongly correlated nuclear core density obtained from Jastrow's theory applied to the finite nucleus. The two-body potentials are replaced by the two-body scattering operators calculated from the potentials of Gammel and Thaler and of Signell and Marshak. ***J. Sawicki and R. Folk.*** *Nuclear Physics*, v. 11, no. 2, May 1959, p. 368-386.

**12035* The Level Structure of $Dy^{160}$.** Gamma rays in $Dy^{160}$ following beta decay of the 72 day $Tb^{160}$ have been studied using coincidence and angular correlation methods. The relative intensity and coincidence measurements confirm the principal features of the decay scheme proposed by Nathan. ***R. G. Arns, R. E. Sund, and M. L. Wiedenbeck.*** *Nuclear Physics*, v. 11, no. 2, May 1959, p. 411-418.

**12036* Mesonic "Exchange" Effects in Beta-Decay.** An estimate is made, using no-recoil meson theory, of the $\pi$-mesonic exchange contributions to the beta-decay of nuclei assuming that such effects only contribute to the axial vector part of the beta-decay interaction. ***R. J. Blin-Stoyle, V. Gupta, and H. Primakoff.*** *Nuclear Physics*, v. 11, no. 2, May 1959, p. 444-453.

**12037* The Poles of the *S*-Matrix of a Rectangular Potential Well or Barrier.** The poles of the S-matrix associated with this problem, in the case of zero angular momentum, are determined, and their behavior as a function of the well depth (barrier height) is discussed. Shows that some poles, previously described as "meaningless", give rise to important physical effects. ***H. M. Nussenzveig.*** *Nuclear Physics*, v. 11, no. 3, June 1959, p. 499-521.

**12038* Polarization of High Energy Protons in Elastic and Inelastic Scattering.** Scattering of 180 MeV protons by Li, Be, B, Fe, and Bi have been measured. ***Arne Johansson, Gunnar Tibell, and Peter Hillman.*** *Nuclear Physics*, v. 11, no. 3, June 1959, p. 540-553.

**12039* Energy and Angular Distributions of Mesonic Hyperfragment Decays.** Shows that the angular asymmetry observed in three-pronged hyperfragment decays of this type can result from low-energy nuclear resonances (compound nucleus formation). ***N. Byers and W. N. Cottingham.*** *Nuclear Physics*, v. 11, no. 3, June 1959, p. 554-568.

**12040* Analysis of Experimental Data on Nucleon Capture Reactions.** Estimates are made of capture cross-sections with emphasis on those for capture of 14 MeV neutrons by heavy elements. ***A. M. Lane and J. E. Lynn.*** *Nuclear Physics*, v. 11, no. 4, June 1959, p. 646-669.

**12041* On the Universal Fermi Interaction.** Expresses the universal Fermi interaction between fermions in a concise form. ***W. Królikowski.*** *Nuclear Physics*, v. 11, no. 4, June 1959, p. 687-690.

**12042* Angular Distributions for Elastic and Inelastic Scattering of 40-MeV Alpha Particles by Carbon, Nitrogen, Oxygen, and Argon.** Gas targets were used. Angles of observation ranged from 7° to 130° (laboratory) for C. Interaction

radii determined. ***A. I. Yavin and C. W. Farwell.*** *Nuclear Physics*, v. 12, no. 1, June 1959, p. 1-34.

**12043* Connection Between Masses and Isobaric Spin.** Fundamental theory of the elementary particles is presented. All masses, with the exception of charged pions and muons, are predicted with a remarkable accuracy. Existence of a pion with zero isobaric spin is predicted. ***Ettore Minardi.*** *Nuclear Physics*, v. 12, no. 1, June 1959, p. 35-57.

**12044* The Proper Field on a Physical Nucleon.** The energy values of Tomonaga's intermediate coupling equation for a physical nucleon are obtained. The possibility that the asymptotic solution for the ground state will give a good description of the situation at small distances from the core of nucleons is discussed. ***Ning Hu.*** *Nuclear Physics*, v. 12, no. 1, June 1959, p. 87-102.

**12045* Nucleate Boiling Characteristics of Organic Reactor Coolants.** ***D. P. Jordan and G. Leppert.*** *Nuclear Science and Engineering*, v. 5, June 1959, p. 349-359.

**12046* Two Region Studies in Slightly Enriched Water-Moderated Uranium and Uranium Dioxide Lattices.** ***John J. Volpe, et al.*** *Nuclear Science and Engineering*, v. 5, June 1959, p. 360-370.

**12047* A Monte Carlo Method for Criticality Problems.** ***W. Goad and R. Johnston.*** *Nuclear Science and Engineering*, v. 5, June 1959, p. 371-375.

**12048* The Use of Thermally Black Control Sheets.** Three special cases are examined: A finite slab reactor with a control sheet at its midplane, an infinite slab reactor containing an array of uniformly spaced control sheets, and a finite slab reactor with two control sheets placed symmetrically about the reactor centerline. ***J. McWhorter, John Russell, and Bertram Wolfe.*** *Nuclear Science and Engineering*, v. 5, June 1959, p. 382-389.

**12049* Turbulent Liquid-Metal Heat Transfer in Channels.** A solution is derived and evaluated for the general case of a turbulently flowing liquid metal. Local Nusselt moduli, dimensionless mixed-mean fluid temperatures, and arithmetic-mean Nusselt moduli are given as functions of Reynolds and Prandtl moduli and a dimensionless axial-distance modulus. ***H. F. Poppendiek.*** *Nuclear Science and Engineering*, v. 5, June 1959, p. 390-404.

**12050 G-M Counters.** G-M tube technology is discussed in this article by first outlining present ideas of the mechanisms of Geiger discharges and then describing the newer designs. ***K. Van Duuren, A. J. M. Jaspers, and J. Hermsen.*** *Nucleonics*, v. 17, June 1959, p. 86-94.

**12051 Armour Dust-Fueled Reactor.** Concept and development to date. ***D. Krucoff.*** *Nucleonics*, v. 17, June 1959, p. 100 + 4 pages.

**12052 SRE Decay-Heat Problem Solved by Eddy-Current Brake.** Excessive thermal stresses have been minimized. ***W. S. De Bear.*** *Nucleonics*, v. 17, June 1959, p. 108 + 4 pages.

**12053 Los Alamos Plasma Thermocouple.** A success in converting heat from fissioning material directly into electricity is reported. ***G. M. Grover.*** *Nucleonics*, v. 17, July 1959, p. 54-55.

**12054 Nucleonics Fundamentals.** ***David B. Hoisington.*** 392 pp. 1959. McGraw-Hill, New York. (QC777 H68n)

**12055* Radioactive Wastes May Become Future Oil-Recovery Tool.** Discusses Cobalt 60 gamma radiation effects on pure methane, ethane, propane, and mixtures of these. ***Robert J. Enright.*** *Oil Engine and Gas Turbine*, v. 57, July 1959, p. 72-74.

**12056* Precision Measurements of Bubble Chamber Film.** The bubble chamber has increased the amount of data available. ***Hugh Bradner.*** *Photogrammetric Engineering*, v. 25, no. 3, June 1959, p. 445-449.

**12057 Low-Intensity Converison Lines From $Sm^{151}$ and $Sn^{119}$.** The electron spectrum of $Sm^{151}$ has been measured with a lens spectrometer and its gamma-ray spectrum with a scintillation spectrometer. The $L$-conversion coefficient 21.7 ± 0.3 kev de-excitation of the first excited state of $Eu^{151}$ is 20 ± 4, with $\alpha L/\alpha M+N) = 2.2 \pm 0.4$ and $\alpha M/\alpha N = 2.2 \pm 0.2$ indicating $M1$ multipolarity. Measurements of the electron spectrum of $Sn^{119}$ with the lens spectrometer reveal the existence of a weak conversion line corresponding to a transition of 253 kev. The intensity of this conversion line is $(2.8 \pm 1.0) \times 10^{-3}$ of the intensity of the conversion line from the 392-kev transition. ***W. T. Achor, W. E. Phillips, J. I. Hopkins, and S. K. Haynes.*** *Physical Review*, v. 114, ser. 2, no. 1, Apr. 1, 1959, p. 137-142.

**12058 Gamma-Ray Excitation of the 15.1-Mev Level in $C^{12}$.** The parameters of the 15.1-Mev level in $C^{12}$ have been determined. The angular distribution of scattered photons has been determined to be dipole. The radiation width to the 4.43-Mev state of $C^{12}$ is determined to be 3.2 ± 2.5 ev by fitting the detector resolution function to observed pulse-height spectra. ***E. L. Garwin.*** *Physical Review*, v. 114, ser. 2, no. 1, Apr. 1, 1959, p. 143-154.

**12059 Excitation Functions of $U^{235}$ and $U^{238}$ Bombarded With Helium and Deuterium Ions.** Cross sections were measured for the reactions $U^{238}(d,p)U^{239}$, $U^{238}(d,2n)Np^{238}$, $U^{238}(d,4n)Np^{236}$(22 hr), $U^{238}(d,t;d,p2n)U^{237}$, $U^{235}(d,n)Np^{236}$(22 hr); $U^{235}(d,2n)Np^{235}$, and $U^{235}(d,3n)Np^{234}$ induced by deuterons of energies from 5.8 to 21.5 Mev. The above excitation function are compared with similar excitation functions of nonfissible nuclei to show the effect of fissionability on spallation cross sections. ***J. Wing, W. J. Ramler, A. L. Harkness, and J. R. Huizenga.*** *Physical Review*, v. 114, ser. 2, no. 1, Apr. 1, 1959, p. 163-173.

**12060 0-600 kev Gamma-Ray Spectra From Thermal Neutron Capture in the Region $A = 104$ to 198.** The neutron capture gamma-ray spectra of Rh, Ag, In, and Sn can roughly be characterized as having an isolated cluster of partially resolved low-energy peaks. The same description can be approximately applied to the heavier Tm, Re, Ir, and Au. However, the intervening I, Eu, Tb, and Ho have a single low-energy peak. ***James E. Draper.*** *Physical Review*, v. 114, ser. 2, no. 1, Apr. 1, 1959, p. 268-278.

**12061 Cross-Relaxation in Spin Systems.** Energy transfer between adjacent resonances in nuclear and electron spin systems is analyzed in terms of the overlap of line-shape functions. Implications for the operation of solid state masers are discussed. ***N. Bloembergen, S. Shapiro, P. S. Pershan, and J. O. Artman.*** *Physical Review*, v. 114, ser. 2, no. 2, Apr. 15, 1959, p. 445-459.

**12062 Reaction Mechanism in Inelastic Scattering of Protons From Mg, Cr, and Other Elements From 3.5 to 7 Mev.** Inelastic scattering of protons leading to the first excited states has been studied. Angular distributions of inelastically scattered protons and $p'-\gamma$ angular correlations were taken at several energies. Measurements are compared with direct-interaction theory and with predictions of the statistical model. ***Frederick D. Seward.*** *Physical Review*, v. 114, ser. 2, no. 2, Apr. 15, 1959, p. 514-525.

**12063 Evidence for Three-Body Vector Forces in Light Nuclei.** Splittings of the $P$-doublet states of $Li^7$ and $N^{15}$, and the $D$-doublet states of $O^{17}$, are calculated with phenomenological three-body vector force of the type expected to arise from higher order effects of the tensor force. ***Arnold M. Feingold.*** *Physical Review*, v. 114, ser. 2, no. 2, Apr. 15, 1959, p. 540-549.

**12064 Total Neutron Yields From Light Elements Under Proton and Alpha Bombardment.** Cross sections have been measured for targets of D, T, $Li^7$, $Be^9$, $B^{11}$, $C^{13}$, $C^{14}$, and $F^{19}$ under proton bombardment and of $Li^7$, $Be^9$, $B^{10}$, and $Si^{29}$ under $\alpha$-particle bombardment. Energy ranges were contained between threshold and 5 Mev for protons and between threshold and 9 Mev for alphas. ***J. H. Gibbons and R. L. Macklin.*** *Physical Review*, v. 114, ser. 2, no. 2, Apr. 15, 1959, p. 571-580.

**12065 Analysis of the $\Lambda$-Hypernuclear Three-Body Systems.** Variational method with a six-parameter trial function is used. An upper bound for the strength of the $\Lambda$-nucleon interaction required to account for the observed binding of the $T = 0$ hypertriton $\Delta H^3$ is obtained. An improved quantitative

estimate of the spin dependence of the Λ-nucleon interaction is obtained. ***B. W. Downs and R. H. Dalitz.*** *Physical Review*, v. 114, ser. 2, no. 2, Apr. 15, 1959, p. 593-602.

**12066 Unnatural Parity States in $O^{16}$. I.** Investigations carried out via the $N^{14}$ $(He^3,p\gamma)O^{16}$ reaction. Direct measurements on the proton and γ-ray spectra and with proton-γ coincidence measurements performed to elucidate the electromagnetic de-excitation of certain of the $O^{16}$ states. ***D. A. Bromley, H. E. Gove, J. A. Kuehner, A. E. Litherland, and E. Almqvist.*** *Physical Review*, v. 114, ser. 2, no. 3, May 1, 1959, p. 758-774.

**12067 Unnatural Parity States in $O^{16}$. II.** Uses $N^{14}(He^3,p)O^{16}$ reaction. Direct measurements of the γ-ray and proton spectra and proton-γ coincidence measurements are reported, in addition to angular distributions of γ rays and of protons and proton-γ angular correlations. ***J. A. Kuehner, A. E. Litherland, E. Almqvist, D. A. Bromley, and H. E. Gove.*** *Physical Review*, v. 114, ser. 2, no. 3, May 1, 1959, p. 775-785.

**12068 Deviation From the ε Approximation in First Forbidden β Decay.** The two transitions, $3(\beta)2(\gamma)0$ and $2(\beta)2(\gamma)0$, are discussed. General energy and angular dependences are given in convenient form for various observables, and are shown numerically for $Sb^{124}$. ***Tsuneyuki Kotani.*** *Physical Review*, v. 114, ser. 2, no. 3, May 1, 1959, p. 795-806.

**12069 Experiments Concerning the Low-Energy States of the $O^{19}$ Nucleus.** Angular distributions have been measured for three groups of protons from the $O^{18}(d,p)O^{19}$ reaction, those leaving $O^{19}$ in its states at 0,0.096, and 1.47 Mev. ***W. Zimmermann, Jr.*** *Physical Review*, v. 114, ser. 2, no. 3, May 1, 1959, p. 837-846.

**12070 Gross Structure in (*d*,*p*) Reactions Near $Z = 50$.** Proton spectra from $Sn^{120}(d,p)$ $Sn^{121}$ and $In^{115}(d,p)In^{116}$ at 19.7 Mev are presented, covering 6.5 Mev of excitation in the product nucleus and laboratory angles from 15° to 155° at 10° intervals. ***R. A. Peck, Jr.*** *Physical Review*, v. 114, ser. 2, no. 3, May 1, 1959, p. 847-857.

**12071 Photon and Electron Polarization in High-Energy Bremsstrahlung and Pair Production With Screening.** Matrix element is written in a particularly simple form which reduces to the well-known matrix element for nonrelativistic energies. Cross sections involving arbitrarily polarized photons and electrons has been calculated. Coulomb and screening effects are taken into account exactly. ***Haakon Olsen and L. C. Maximon.*** *Physical Review*, v. 114, ser. 2, no. 3, May 1, 1959, p. 887-904.

**12072 $\Lambda^\circ$ and $\Sigma^\circ$ Production From the ($\Sigma^-$,*d*) System.** Calculations are presented and two ways of modification of cited results are discussed. ***T. B. Day, G. A. Snow, and J. Sucher.*** *Physical Review Letters*, v. 2, no. 11, June 1, 1959, p. 468-470.

**12073 Radiative Corrections to π-*e* Decay.** The large radiative correction found by Berman in $R(\Delta E)$ may be regarded as a consequence of the high efficiency of the π-*e* system as an emitter of hard photons. The pion decay gives additional support for the general validity of the conjectured "theorem". ***Toichiro Kinoshita.*** *Physical Review Letters*, v. 2, no. 11, June 1, 1959, p. 477-480.

**12074* Possible Methods for the Determination of Strange-Particle Parities.** ***A. Sirlin and R. Spitzer.*** *Physical Review Letters*, v. 3, no. 2, July 15, 1959, p. 110-111.

**12075* Elastic and Inelastic Scattering of 22 Mev Alpha Particles by Light Elements.** The scattering of 22 Mev alpha particles from C, Mg, and Si has been studied with scintillation counter technique. The elastic scatterings from C and Mg have shown the characteristic diffraction pattern, which can be obtained from the theory of diffraction by an opaque sphere. ***Chuin Hu, Shohei Kato, Yukiyasu Oda, and Minoru Takeda.*** *Physical Society of Japan, Journal*, v. 14, May 1959, p. 549-554.

**12076* $Be^9(n,2n)$ $Be^8$ and $B^{11}(n,\alpha)Li^8(\beta)Be^8$ Reactions by 14 Mev Neutrons.** $Be^9(n,2n)Be^8$ and $B^{11}(n,\alpha)Li^8(\beta)Be^8$ reactions induced by 14 Mev neutrons were studied by the method of Be and B loaded nuclear emulsions. ***Masakatsu Sakisaka.*** *Physical Society of Japan, Journal*, v. 14, May 1959, p. 554-563.

**12077* Absolute Cross Sections of the (γ,π) Reaction for $Cu^{63}$, $Zn^{64}$ and $Ag^{109}$.** ***Teruo Nakamura, et al.*** *Physical Society of Japan, Journal*, v. 14, June 1959, p. 693-698.

**12078* Gamma Rays From Neutron Inelastic Scattering of Magnesium, Aluminum, Iron and Bismuth.** ***Masanao Hosoe and Shoji Suzuki.*** *Physical Society of Japan, Journal*, v. 14, June 1959, p. 699-706.

**12079* Angular Distributions of the Reaction $F^{19}(p,\alpha)O^{16}$ at 8.0~14.2 Mev.** ***Hiroshi Ogata.*** *Physical Society of Japan, Journal*, v. 14, June 1959, p. 707-713.

**12080* Excitation Functions and Angular Distributions of the Reactions $Al^{27}(p,\alpha)Mg^{24}$ at 12.7~14.1 Mev and $Cr^{52}(p,\alpha)V^{49}$ at 9.0~14.2 Mev.** ***Isao Kumabe, et al.*** *Physical Society of Japan, Journal*, v. 14, June 1959, p. 713-721.

**12081 On the Measurement of $\pi^+$ Meson Photoproduction From Hydrogen Near Threshold.** A new counter method has been developed for measuring $\pi^+$ meson photoproduction near threshold. It has been employed, in particular, to examine the variation with energy of the differential cross section from H, at laboratory angles of 115° and 90° to the gamma-ray beam of the Glasgow synchrotron. ***G. M. Lewis and R. E. Azuma.*** *Physical Society, Proceedings*, v. 73, pt. 6, June 1959, p. 873-880.

**12082* Performance of the Sodium Reactor Experiment.** ***J. E. Owens, W. T. Morgan, and L. E. Glasgow.*** *Power Apparatus and Systems*, 1959, no. 42, June, p. 170-175.

**12083* The Construction of Boron Ionization Chambers.** Three series of ionization chambers are described: of KN, filled with $BF_3$, of KNT, having a solid B cover, and of KNK, compensated to the effect of a γ background. (*In Russian.*) Konstruktsiia bornykh ionizatsionnykh kamer. ***A. B. Dmitriev, M. G. Borob'ev, L. G. Kosmarskaia, and N. I. Chipurenko.*** *Pribory i Tekhnika Eksperimenta*, 1959, no. 3, May-June, p. 59-62.

**12084* The Geometric Correction Factor for a Cylindrical Ionization Chamber.** The necessity of calculation of the effect of the geometric factor on the measurement of the efficiency of the dose of γ-radiation of cylindrical ionization chamber, the linear dimensions of which are comparable with the distance from the center of the chamber to the point of the source, is discussed. (*In Russian.*) Popravochnyĭ geometricheskiĭ faktor dlia tsilindricheskoĭ Ionizatsionnoĭ kamery. ***E. E. Kovalev and V. I. Popov.*** *Pribory i Tekhnika Eksperimenta*, 1959, no. 3, May-June, p. 63-66.

**12085 Principles of Radiation Dosimetry.** ***G. N. Whyte.*** 119 pp. 1959. John Wiley & Sons, New York. (QC457 W62r)

**12086 Proceedings of the 1957 Fast Reactor Information Meeting.** Describes the status of the Fast Breeder Reactor Programs and Fast Reactor Safety Programs for the benefit of access permit holders from industry. ***G. W. Wensch, editor.*** 282 pp. 1957. Available from Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. (TK9203.F2 Un3.1p)

**12087 Proceedings of the Second United Nations International Conference on the Peaceful Uses of Atomic Energy. XV. Physics in Nuclear Energy.** v. XV. 476 pp. 1958. United Nations, Geneva. (QC770 In8p2 Over.)

**12088* On the Absorptive Range in the Pion-Nucleon Collision at High Energies.** ***Kin-ichi Ishida.*** *Progress of Theoretical Physics*, v. 21, no. 5, May 1959, p. 676-680.

**12089 Radiations From Radioactive Atoms in Frequent Use.** Tables of characteristics for 17 separate elements. ***L. Slack and K. Way.*** 75 pp. Feb. 1959. U. S. Atomic Energy Commission, Washington, D. C. (QC798 Un3.1r)

**12090* Reprocessing of Irradiated Fission Reactor Fuel and Breeding Material.** A listing containing 119 references to unclassified reports. ***James M. Jacobs, compiler.*** 11 pp. May 1959. Office of Technical Services, Department of Commerce, Washington, D. C. (ZTK9360 Un3.1r Ref.)

**12091 The Scattering of Alpha Particles by Helium.** In order to obtain information about the levels of even spin and parity of $^8$Be at energies above 11 MeV, the differential cross-

section for the α-particle-helium elastic scattering has been measured at a series of beam energies from 23·1 to 38·4 MeV, for many c.m.s. angles between 30 and 90°. Phase shifts up to $L = 8$ have been calculated for each energy. ***D. J. Bredin, et al.*** *Royal Society, Proceedings,* v. 251, ser. A, May 26, 1959, p. 143-155.

**12092 Proton-Proton Interactions at 970 MeV.** The results from 273 events of the type $p+p \rightarrow n+p+\pi^+$, and 72 events of the type $p+p \rightarrow p+p+\pi^0$, have been calculated in detail. They are compared with the predictions of the 'isobar' theory of pion production, in which it is postulated that the production of pions occurs through an intermediate state of isotopic spin $T = \frac{3}{2}$. The results for positive pion production are in good agreement with this hypothesis, and disagree markedly with the prediction of a purely statistical theory. The results for neutral pion production do not agree well with the predictions of the isobar theory. ***A. P. Batson, B. B. Culwick, J. G. Hill, and L. Riddiford.*** *Royal Society, Proceedings,* v. 251, ser. A, May 26, 1959, p. 218-232.

**12093 Proton-Deuteron Interactions at 970 MeV.** The results for inelastic scattering indicate that, assuming charge independence, the formation of excited nucleons of isotopic spin $\frac{3}{2}$ does not dominate the process of pion production. This is also true for the Russian data. Twelve cases of double meson production were observed. The angular distribution of proton-neutron elastic scattering has the form expected from lower energy data. ***A. P. Batson, B. B. Culwick, H. B. Klepp, and L. Riddiford.*** *Royal Society, Proceedings,* v. 251, ser. A, May 26, 1959, p. 233-246.

**12094 Safe Handling of Radioisotopes.** Guide to safe handling. ***G. Randers, et al.*** 99 pp. 1958. International Atomic Energy Agency, Vienna. (RA1231.R2 In8s)

**12095 Teaching With Radioisotopes.** ***Harold A. Miner, Robert W. Shackleton, and Fletcher G. Watson, editors.*** 60 pp. 1959. Available from Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. (TK9400 Un3.1t)

**12096 Engineering Study on Underground Construction of Nuclear Power Reactors.** ***Christian Beck.*** *U. S. Atomic Energy Commission, AECU-3779,* Apr. 15, 1958, 33 pp. (UF767 U3au Contin.)

**12097 Study of 40 MW Pressurized Water, Boiling Water, and Organic Moderated Reactors for Production of Process Steam.** Data are tabulated. The PWR core is the most favorable with a cost of 64-150 cents per 1000 lbs. steam. ***L. E. Link, et al.*** *U. S. Atomic Energy Commission, ANL-6009,* June 1959, 144 pp. (UF767 Un3.1an Contin.)

**12098 The Kinetics and Stability of Fast Reactors With Special Considerations of Nonlinearities.** ***Henry A. Sandmeier.*** *U. S. Atomic Energy Commission, ANL-6014,* June 1959, 83 pp. (UF767 Un3.1an Contin.)

**12099 Description of a Capsule for Irradiation of Fuel Specimens at High Temperatures.** Involved calculating the specimen heat-generation rate and designing an insulating gas gap around the specimens to achieve the desired temperature. The capsule was operated containing small fueled specimens at 1600 to 1650 F. ***Sam J. Basham, John H. Stang, William H. Goldthwaite, and Bruce W. Dunnington.*** *U. S. Atomic Energy Commission, BMI-1336,* Apr. 22, 1959, 24 pp. (UF767 U3b Contin.)

**12100 PWR Core 2 Model Studies to Improve Inlet-Plenum-Chamber Mixing.** Studies to improve mixing in the lower plenum were carried out using a quarter-scale air-flow model. By use of vanes to form a strong vortex in the lower plenum, excellent lower-plenum mixing was obtained with only slight pressure drop. ***Lawrence J. Flanigan, Gale R. Whitacre, and Herbert R. Hazard.*** *U. S. Atomic Energy Commission, BMI-1342,* May 7, 1959, 66 pp. (UF767 U3b Contin.)

**12101 Elastic Scattering of Alpha Particles by $O^{16}$.** Absolute cross sections from a Van de Graaff generator have been measured in a differentially pumped gas scattering chamber. The bombarding energy was varied continuously from 3.7 to 6.5 Mev. ***Lillian Christie McDermott.*** *U. S. Atomic Energy Commission, CU-187,* Apr. 2, 1959, 98 pp. (UF767 Un3.1cu Contin.)

**12102 Preliminary Hazards Evaluation of the Heavy Water Components Test Reactor.** Features of the reactor design that affect reactor safety are described. Representative accidents are postulated and their course followed through conditions in reactor, action of safety systems, and subsequent action of emergency backup facilities. ***Daniel S. St. John.*** *U. S. Atomic Energy Commission, DP-383,* May 1959, 181 pp. (UF767 Un3.1dp Contin.)

**12103* Bibliography on Fission, 1952 to Present.** Consists of 1012 entries. The list does not claim to be either an exhaustive or critical compilation and has not been edited, reviewed, or verified for accuracy. ***Patricia E. Bell and Soliska R. Harris, compilers.*** 208 pp. Sept. 1958. *U. S. Atomic Energy Commission LAMS-2302.* (ZQC790 Un3.1b Ref.)

**12104 Nuclear Studies on the MPR Zero Power Test Core.** Includes critical core configuration; full size core reactivities; neutron flux and power distributions; cell flux distribution; gamma dosage; radial fuel worth; effects of flow baffles, thermal shield and pressure vessel on reactivity and flux distribution; temperature effect on reactivity; control rod design; and control rod evaluation studies. *U. S. Atomic Energy Commission, MND-MPR-1646,* Dec. 23, 1958, 312 pp. (UF767 Un3.1mm Contin.)

**12105 A Summary of the Linear Orbit Properties of an Accelerator Having a General Magnetic Field.** Lists results for the linear orbit properties of an accelerator with a general magnetic field. No derivations are in this report. ***George Parzen.*** *U. S. Atomic Energy Commission, MURA-454,* Apr. 21, 1959, 8 pp. (UF767 Un3.1mu Contin.)

**12106 Organic Moderated Reactor Experiment Quarterly Progress Report, April-June 1957.** Includes corrosion studies and physical properties of coolants. ***C. A. Trilling, editor.*** *U. S. Atomic Energy Commission, NAA-SR-2399,* Dec. 31, 1958, 48 pp. (UF767 Un3.1na Contin.)

**12107 Low-Power Physics Experiments on the Sodium Reactor Experiment.** Critical masses were determined and found to be 22.2 fuel elements, or 42.4 kg of U-235, for the dry reactor (no Na present), and 32.6 fuel elements, or 62.2 kg of U-235, for the wet reactor (Na present at 180 C). ***R. W. Campbell.*** *U. S. Atomic Energy Commission, NAA-SR-3341,* June 15, 1959. 47 pp. (UF767 Un3.1na Contin.)

**12108 Development of the SRE Mark II Safety Rod.** The rod consists of a neutron absorbing column suspended from an electromagnet, which, when de-energized, allows the column to fall into the reactor core. ***E. C. Phillips and R. G. Hoff.*** *U. S. Atomic Energy Commission, NAA-SR-3482,* June 15, 1959, 25 pp. (UF767 Un3.1na Contin.)

**12109 Liquid Metal Loops Irradiated in the ORNL Graphite Reactor and the LITR.** Alkali metals were circulated in a series of structural alloy loops under reactor radiation at high temperature. ***W. W. Parkinson and O. Sisman.*** *U. S. Atomic Energy Commission, ORNL-2630,* June 1, 1959, 33 pp. (UF767 U3o Contin.)

**12110 Molten-Salt Reactor Project Quarterly Progress Report for Period Ending April 30, 1959.** ***H. G. MacPherson.*** *U. S. Atomic Energy Commission, ORNL-2723,* June 26, 1959. 99 pp. (UF767 U3o Contin.)

**12111 20,000 KW Nuclear Power Plant Study for United States Atomic Energy Commission.** Steam-electric generating plant presented consists of a heterogeneous pressurized water reactor with a saturated steam turbine generator unit. *U. S. Atomic Energy Commission, TID-5469,* June 7, 1959, 188 pp. (UF767 Un3ti Contin.)

**12112 Critical Assemblies of Uranium Metal.** Data are summarized. Empirical studies are made for specific reflectors and geometries to determine the feasibility of extrapolating these data for conditions concerning nuclear safety problems. ***R. Gwin and W. T. Mee.*** *U. S. Atomic Energy Commission, Y-1248,* Mar. 26, 1959, 17 pp. (UF767 Un3.1y Contin.)

**12113* The Theory of the Forward Asymmetry on the Photo Disintegration of the Deuteron.** The forward asymmetry in the differential cross section for the photo disintegration of the deuteron has been calculated on the basis of a phenomenological theory for energies up to 80 MeV. The formulas for this asymmetry, which come from the $E_1$-$E_2$- and $M_1$-$M_2$-interference, are given, assuming the validity of Siegert's theorem. (*In German.*) Zur Theorie der Vorwärtsasymmetrie bei der Photospaltung des Deuterons. ***Biswarup Banerjee and Gustav Kramer.*** *Zeitschrift für Physik*, v. 154, no. 5, 1959, p. 513-523.

**12114* Interaction Between 660 MeV Protons and Atomic Nuclei and the Nuclear Internal Momentum Distribution of Nucleons.** In the order of decreasing energy the various spectral regions of all investigated elements correspond respectively to diffractional scattering of protons on nuclei (in the small angle region), single quasi-elastic proton-nucleon collisions, $\pi$-meson production on bound nucleons and intranuclear cascade. The Be and C data are consistent with a Gaussian nucleon momentum distribution with a $1/e$ value at an energy of approximately 20 MeV. (*In Russian.*) Vzaimodeĭstvie protonov s atomnymi iadrami pri energii 660 MeV i vnutriiadernoe raspredelenie impul'sov nuklonov. ***L. S. Azhgireĭ, et al.*** *Zhurnal Eksperimental'noĭ i Teoreticheskoĭ Fiziki*, v. 36, no. 6, June 1959, p. 1631-1649.

***See also:*** **11171** (Pioneer's radiation-detection equipment); **11217** (autoradiography of ceramic tools); **11225** (silica-uranium fuel systems); **11438** (annealing of crystal distortion in irradiated graphite); **11911** (fuel elements for OMR); **11986** (reactor fuel elements); **12134** (nuclear industry law); **12221** (nuclear physical research).

## OPERATIONS RESEARCH AND MANAGEMENT ENGINEERING

**12115* Industrial Leadership in an Age of Change.** Discusses the civic and social responsibilities of industrial leaders. ***Samuel N. Stevens.*** *ASAE Journal*, v. 11, no. 3, July 1959, p. 19-22.

**12116* Spotlight on the Over-40 Worker.** ***Jack Hurt.*** *ASAE Journal*, v. 11, no. 3, July 1959, p. 47 + 4 pages.

**12117* Four Musts of Salary Administration.** One of the lowest paying of 18 subsidiaries of a large corporation got a high rating on an employee-attitude survey of wage policies. Here is the secret of that success. ***Robert R. Dobersteln.*** *American Business*, v. 29, July 1959, p. 30-32.

**12118* Security of Employment.** Discusses various responsibilities of the employer, the employee, and the trade unions towards maintenance of employment. *Coke and Gas*, v. 21, June 1959, p. 236-240.

**12119* Anatomical Factors in Work-Design.** Practical organization of work and adapting task to worker must follow principle of utilizing worker's capacity to best advantage, at the same time taking into consideration his health and strength. ***H. Schnewlin.*** *EPA Bulletin*, no. 32, June 1959, p. 3-10.

**12120* Design of Controls.** In designing a properly laid-out workplace, the following approach is adopted: the man is assumed to be in a natural position and the equipment arranged round him in such a way that all indicators and controls are natural extensions of his neuro-muscular system. ***J. M. Faverge.*** *EPA Bulletin*, no. 32, June 1959, p. 35 + 7 pages.

**12121* Biological Factors in the Arrangement of Working Periods.** The introduction of regular short pauses, far from leading to a decrease in performance or output, helps, on the contrary, to recruit reserves of energy. Improvement in performance thus achieved may possibly justify a shortening of working hours. ***Heinz Schmidtke.*** *EPA Bulletin*, no. 32, June 1959, p. 42-49.

**12122* Job Evaluation for White-Collar Workers.** Gives details on job evaluation in the Netherlands. ***W. J. van den Woestijne.*** *EPA Bulletin*, no. 32, June 1959, p. 55-57.

**12123* Measuring Human Motions for Designing Machines.** Until the development of the UNOPAR (Universal Operator Performance Analyzer and Recorder), it was not possible to measure human work motions effectively. Many uses and benefits of UNOPAR are now affecting the industrial world. ***G. Nadler and J. Goldman.*** *Engineering Journal*, v. 42, June 1959, p. 60-65.

**12124* A Brand-New Breakthrough in Management Development.** Describes the dynamics of National Training Laboratories two-week management training program at Arden House Campus of Columbia University. ***George A. Hoy, Jr.*** *Factory*, v. 117, July 1959, p. 74-79.

**12125* Trends in Human Factors.** An attempt is made to define the metamorphosis of the human factors area since World War II. ***Julien M. Christensen.*** *Human Factors*, v. 1, no. 1, Sept. 1958, p. 2-7.

**12126* A Follow-up Survey of Human Factors Research in Aircraft, Missiles, and Supporting Industries.** A 1957 follow-up of a 1956 survey was made to determine the extent of human factors research in industry. It is estimated that 700 people will be employed in human-factors programs by 1960 in the companies surveyed. ***J. A. Kraft.*** *Human Factors*, v. 1, no. 1, Sept. 1958, p. 23-25.

**12127* The Use of Gliding Cyclograms in the Biomechanical Analysis of Movements.** After a brief review of the optical recording methods of movements, the use of gliding cyclograms in biomechanical analysis of work is discussed. The gliding cyclogram method consists in recording of sequent positions of the moving body segments on photographic film which is transported at a constant speed. ***Rudolfs J. Drillis.*** *Human Factors*, v. 1, no. 2, Apr. 1959, p. 1-11.

**12128 What Human and Social Engineering Means to the Professional Man.** Psychology and philosophy of the social sciences have an important place in the professional man's future. ***W. O. Baker.*** *Industrial and Engineering Chemistry*, v. 51, Aug. 1959, p. 77A-78A.

**12129 Management for the Smaller Company.** This book has been planned to help the manager of the smaller company take a long look at his performance. For the most part, its authors represent manufacturing companies with fewer than 1,000 employees, companies using tested management principles and techniques that are universally valid. Still other contributors are interested specialists—a banker, a team of lawyers, a Government official—with a feeling for the problems of small business. ***Elizabeth Marting, editor.*** 399 pp. 1959. American Management Association, Inc., New York. (HD31 Am35ms)

**12130 Manual of Excellent Managements.** An audit of the organization and management policies of some well-managed companies. 5th Ed. 193 pp. 1959. American Institute of Management, New York. (HD31 Am35m Vis.)

**12131* Industrial Engineering for the Small Foundry. A Practical Approach.** All recommendations and conclusions are made with a view to practical application in the small, as opposed to the large, foundry. For the purpose of this discussion, the small foundry is defined as one which has approximately 50 to 100 employees. ***F. E. Noggle.*** *Modern Castings*, v. 36, July 1959, p. 51-61.

**12132* A Report on Some Organizational Experiments.** An organizational analog is constructed in the form of an operational game to be used for testing hypotheses concerning the effect of organizational structure on the efficiency of organizational performance. The ultimate objective is to develop mathematical theory which makes this relation explicit. ***Donald F. Clark and Russell L. Ackoff.*** *Operations Research*, v. 7, no. 3, May-June 1959, p. 279-293.

**12133 Job Counseling Is a Partnership.** Rating and counseling employees means a more profitable organization. This article presents three simple, helpful suggestions. ***Carl Mullins White.*** *Petroleum Engineer*, v. 31, July 1959, p. E1-E2.

**12134 Progress in Nuclear Energy. Series X. Law and Administration.** Legislation and administrative procedures and practices in various countries; international agencies and typical bilateral agreements. ***Herbert S. Marks, editor.*** v. I. 994 pp. 1959. Pergamon Press, New York. (QC776 P94n)

**12135* A Critique and Experimental Design for the Study of the Relationship Between Productivity and Job Satisfaction.** An examination of characteristics of workers who are operating at a satisfactory level of both output and job satisfaction with workers and groups of workers who are not operating at such a level. ***Harry C. Triandis.*** *Psychological Bulletin*, v. 56, no. 4, July 1959, p. 309-312.

**12136 What Every Supervisor Should Know.** Through 700 straight-forward questions and answers, this book effectively communicates a great deal about industrial operations and understanding and dealing with people. Supplementing the questions and answers are helpful case studies, charts, and amusing cartoons by Al Ross. ***Lester R. Bittel.*** 451 pp. 1959. McGraw-Hill, New York. (HF5549 B54w)

***See also:*** **11713** (human factors bibliography).

## ORE AND MATERIALS BENEFICIATION

**12137* Commercial Production of Indium.** Indium is produced from dross re-treatment furnace D. R. F. slag, a complex by-product of the lead smelting operations. ***B. G. Hunt, C. E. T. White, and R. A. King.*** *Canadian Mining and Metallurgical Bulletin*, v. 52, no. 566, June 1959, p. 359-365; *Canadian Institute of Mining and Metallurgy, Transactions*, v. 62, 1959, p. 173-179.

**12138 Which Process to Free Rare Earths From Raw Monazite Ore?** Two major processes and why particular techniques are used. *Chemical Engineering*, v. 66, July 27, 1959, p. 62-64.

**12139 Rare Earths Face 2 Challenges.** To reduce costs and develop new uses for the refined materials. *Chemical Engineering*, v. 66, July 27, 1959, p. 66 + 1 page.

**12140* The Story of Asbestos. I. Nature's Greatest Anomaly.** ***Peter Sleight.*** *Compressed Air Magazine*, v. 64, July 1959, p. 17-19.

**12141 A Guide to Solid-Liquid Separations.** Tables for use in determining uniform velocity of spherical particles; separations based on velocity. ***F. J. Fontein.*** *Engineering and Mining Journal*, v. 160, July 1959, p. 82-85.

**12142* Advances in Uranium Ore Processing.** Grinding; leaching; ion exchange; solvent extraction and upgrading, and concentrating. ***William L. Lennemann and Frank E. McGinley.*** *Mining Congress Journal*, v. 45, July 1959, p. 59-63.

**12143* LPF Was the Key to Oxide Recovery.** Installation of a leach-precipitation-flotation process increased Cu recovery by 2 lbs. per ton of ore treated. *Mining World*, v. 21, no. 7, June 1959, p. 31-33.

**12144* New Guides to Chrysocolla Flotation.** Test program indicates chrysocolla can be activated and floated by an easily controlled method of sulphidization. The reagent combination may yield satisfactory recovery of other oxides and sulphides in a mixed copper ore. ***John A. Jaekel.*** *Mining World*, v. 21, no. 8, July 1959, p. 44-46.

**12145* Contribution to the Theory of Collector Fixation in Cation-Active Flotation.** The relationship between the structure of mineral and collector, the theory of accordance of ionic radii, and the theory of collector fixation as a result of negative heats of solution are discussed. (*In German.*) Beitrag zur Theorie der Sammlerfixierung bei kationaktiver Flotation. ***Heinrich Schubert.*** *Neue Hütte*, v. 4, June 1959, p. 333-342.

**12146* Methods for the Further Improvement and Intensification of the Electric Refining of Copper.** Raising the quality of the cathodic matrix plates and maintaining the current density on an average level improved the production by 3 to 4%. Covering the matrix with lead in hydrofluoboric electrolyte lengthened their life in service. The ferroconcrete vats were replaced by electrolyte heaters made of 6 mm thick rustproof sheets of steel type 1X18H9T. The effect of additions of surface active substances was examined. (*In Russian.*) Puti dal'neIshego uluchsheniia i intensifikatsii protsessa elektrorafinirovaniia medi. ***A. I. Levin and V. I. Vlasov.*** *Tsvetnye Metally*, v. 32, no. 5, May 1959, p. 32-38.

**12147 Uranium Extraction by Tri-*n*-Octylamine Sulfate.** Extraction of U from acidic sulfate aqueous systems by benzene solutions of tri-*n*-octylamine sulfate was studied under various conditions of U loading, acid activity, sulfate ion concentration, and amine concentration. The present evidence suggests only very low or negligible proportions of the trisulfate complex at sulfate molarities below 1. ***Kenneth A. Allen.*** *U. S. Atomic Energy Commission, ORNL-2709*, June 4, 1959, 26 pp. (UF767 U3o Contin.)

**12148 Extraction of Rare-Earth Elements From Bastnaesite Concentrate.** Digesting of a flotation concentrate with sulfuric acid converts the rare-earth compounds from fluorocarbonates to sulfates releasing gaseous compounds of F and Si, and leaving the sulfated material free of these elements. Calcining the sulfated material at 1,200 F renders the gangue constituents insoluble, whereas the rare-earth sulfates are left in water-soluble form. ***Van E. Shaw.*** *U. S. Bureau of Mines Report of Investigations* 5474, 1959, 12 pp. (TN21 Un3r Vis.)

**12149 Hydration-Rate Studies of Gypsum Plasters: Effects of Small Amounts of Dissolved Substances.** ***J. P. Coughlin, K. C. Conway, M. F. Koehler, and D. F. Barry.*** *U. S. Bureau of Mines Report of Investigations* 5477, 1959, 23 pp. (TN21 Un3r Vis.)

## PHYSICS

**12150 Compressional Relaxation in Liquids.** A set of phenomenological equations, valid at all frequencies, is proposed for the rates of change of internal relaxation parameters describing molecular excitations and structural changes in a liquid. An Onsager coupling is found to exist between the rate equations for the parameters and the pressure tensor, so that the diagonal terms of the pressure contain a linear sum of thermodynamic affinities governing the internal irreversible processes. ***R. E. Nettleton.*** *Acoustical Society of America, Journal*, v. 31, May 1959, p. 557-567.

**12151 Absorption of Sound by a Strip of Absorptive Material in a Diffuse Sound Field.** The random incidence sound absorption coefficient is calculated for a narrow strip of absorbing material set in an otherwise reflecting plane. The assumptions made are that the material is of the locally reacting type, with a real normal admittance. The results show the increase in absorption coefficient that occurs at small widths due to diffraction. ***T. D. Northwood, M. T. Grisaru, and M. A. Medcof.*** *Acoustical Society of America, Journal*, v. 31, May 1959, p. 595-599.

**12152 Ultrasonic Spectroscopy in Liquids.** Relaxation processes which include such phenomena as vibrational, isomeric, structural and shear relaxation effects are studied. ***T. A. Litovitz.*** *Acoustical Society of America, Journal*, v. 31, June 1959, p. 681-691.

**12153 Hot Wire Method for Visualizing Intense Stationary Sound Waves.** The nodes and antinodes of the sound waves appear as a series of alternate incandescent and dark areas on the wire. ***R. M. Fand and J. Kaye.*** *Acoustical Society of America, Journal*, v. 31, June 1959, p. 810-811.

**12154* Sabine Reverberation Equation and Sound Power Calculations.** Formulas pertaining to the calculation of noise in a room produced by a steady source, measurement of sound power in a reverberant room, and calculation of reverberation time are reviewed for their appropriateness to engineering use. ***Robert W. Young.*** *Acoustical Society of America, Journal*, v. 31, July 1959, p. 912-921.

**12155* Mutual Radiation Impedance of Sources on a Sphere.** Expressions are derived in cases of uniformly vibrating circular and rectangular acoustic sources on a rigid spherical baffle. ***Charles H. Sherman.*** *Acoustical Society of America, Journal*, v. 31, July 1959, p. 947-952.

**12156* Optics in the Wind Tunnel.** How schlieren system is used to observe and record shock-wave phenomena. ***J. Philip Geddes.*** *Aircraft and Missiles Manufacturing*, v. 2, June 1959, p. 46-47.

**12157* Equation for the Wave Function of a System of *N* Particles in the Problem of Many Bodies.** A method permitting the calculation of the correlation of $N$ particles in a problem where a full number of particles $N' > N$ exists, was applied to the investigation of an equation for the wave function of a system $N$ of particles in a problem of many bodies in order to use it with processes where the preponderant role is played by the correlation of many particles. (*In Russian.*) Uravnenie dlia volnovoĭ funktsii sistemy $N$ chastits v zadache mnogikh tel. ***V. G. Solov'ev.*** *Akademiia Nauk SSR, Doklady*, v. 126, no. 4, June 1, 1959, p. 755-758.

**12158* Approach to the Quantum Mechanical Many-Body Problem With Strong Two-Particle Interaction. II.** Discussed are the system of one-dimensional fermions, the three-dimensional system of Fermi-particles, the three-dimensional system of four spinless fermions, particles with spin. A suggestion for the nuclear problem, and a comparison with the Tastrow method, are given. ***Evert Andersén.*** *Arkiv för Fysik*, v. 15, no. 2, 1959, p. 181-192.

**12159 Energy Variation With Pressure and Temperature in a Sonic Stationary Wave.** In media of air, carbon dioxide, and coal gas, the variations of the energy per wave per unit area $E$ with pressure $p$ at different temperatures have been plotted, and a relationship of the form $E = Kp^m$ obtained. ***A. R. Ingles.*** *British Journal of Applied Physics*, v. 10, June 1959, p. 246-250.

**12160 Effect of Sound Intensity on Dispersion and Coagulation in Ultrasonic Emulsification.** Determined by following the rate of emulsification. The nucleation phenomenon is also studied. ***R. S. Krishnan, V. S. Venkatasubramanian, and E. S. Rajagopal.*** *British Journal of Applied Physics*, v. 10, June 1959, p. 250-252.

**12161* Heat Transfer in the Rarefied Gases. I-II.** Problem of steady one-dimensional heat transfer between two parallel plates in the rarefied gases is studied. ***Tetsuo Fujimoto and Kichiro Takao.*** *Bulletin of JSME*, v. 2, no. 6, May 1959, p. 197-209.

**12162 Crystal Growth and the Thermodynamics of Irreversible Processes.** The principle of minimum rate of entropy production is applied to steady-state transport processes in the neighborhood of an alloy crystal face growing into its melt. It is noted that segregation, which occurs in cellular or dendritic growth of alloys, is a direct manifestation of the system's attempt to minimize entropy production by conserving free energy. ***J. S. Kirkaldy.*** *Canadian Journal of Physics*, v. 37, June 1959, p. 739-754.

**12163* The Scattering of Electromagnetic Waves by a Corrugated Sheet.** The physical optics method is used to determine scattering of a plane wave by a perfectly conducting sheet having sinusoidal corrugations. ***T. B. A. Senior.*** *Canadian Journal of Physics*, v. 37, July 1959, p. 787-797.

**12164* Modification of PbS Noise Spectra by Radiation.** The noise spectra of PbS photoconductive cells can be modified by optically excited carriers. Detailed wavelength studies at $CO_2$ temperatures have shown that g-r noise can be obtained using light of the 2.4-micron region, and the $1/f$ form with radiation of the 1.0-micron region. ***R. L. Williams.*** *Canadian Journal of Physics*, v. 37, July 1959, p. 841-847.

**12165* The Clock Problem (Clock Paradox) in Relativity. Theories, Both Pro and Con, Recorded in the Literature. An Annotated Bibliography.** Consists of 241 entries; the majority are in English. ***Mildred Benton, compiler.*** 48 pp. 1959. U. S. Naval Research Laboratory, Washington, D. C. (ZQC6 B44c Ref.)

**12166* The Use of the Repulsive Potential in the Quantum Theory of Solids.** A new method is proposed for calculating the energy in certain special points of the Brillouin zone. (*In Russian.*) Ispol'zovanie ottalkivaiushchego potentsiala v kvantovoĭ teorii tverdykh tel. ***Emil Antončík.*** *Czechoslovak Journal of Physics*, v. 9, no. 3, 1959, p. 291-305.

**12167 Thermoelectricity—State of the Art.** A brief outline of thermoelectricity, problems involved, and work being done by a few of the larger companies. ***Christopher Celent.*** *Electronic Industries*, v. 18, July 1959, p. 66-78.

**12168 Experimental Techniques in Low-Temperature Physics.** Provides those becoming interested in the investigation of materials at low temperatures, with information needed to carry out their investigations. ***Guy Kendall White.*** 328 pp. 1959. Oxford University Press, London. (QC278 W58e)

**12169* The Optics of Mirages.** ***C. V. Raman and S. Pancharatnam.*** *Indian Academy of Sciences, Proceedings*, v. 49, sec. A, no. 5, May 1959, p. 251-261 + 1 plate.

**12170 Introduction to Dynamics.** Studies motion in two dimensions—particle, rigid body, system—without Lagrange's equations. A general introduction to the subject. ***L. A. Pars.*** 497 pp. 1953, Cambridge University Press, New York. (QA845 p25i)

**12171* Investigations of Spark Disc Counters.** The gas discharge mechanism in the spark disc counter was examined in the acetone-argon mixture by measurements of the Townsend coefficients and the plateau at different mixing proportions and gas pressures. It appears that there is a maximum value of the over-voltage and of the gas amplification factor, which both lie at a mixing proportion of about 10% and a pressure between 300 and 400 Torr. (*In German.*) Untersuchungen an Funkenplattenzählern. ***Erich Bagge and Lothar Schmieder.*** *Atomkernenergie*, v. 4, May 1959, p. 169-181.

**12172 Transient Response of Grain Boundaries and Its Application for a Novel Light Sensor.** Studies on *n*-type Ge. ***Rolk K. Mueller.*** *Journal of Applied Physics*, v. 30, July 1959, p. 1004-1010.

**12173 Ferroelectric Properties of Colemanite.** The ferroelectric properties of the calcium borate mineral colemanite are investigated in the ferroelectric and paraelectric temperature regions. It is shown that Devonshire's phenomenological theory may be applied successfully to account for the experimental measurements of spontaneous polarization and electrical susceptibility over a wide temperature range. ***H. H. Wieder.*** *Journal of Applied Physics*, v. 30, July 1959, p. 1010-1018.

**12174 Some Characteristics of a Magnetically Focused Electron Beam.** Influence of the optics of the electron gun on the beam-focusing characteristics, the effects of transverse "thermal" velocities, the change in the internal beam dynamics with increasing values of magnetic focusing field, etc. A simple model of the beam is used to explain certain of the observed characteristics. ***George R. Brewer.*** *Journal of Applied Physics*, v. 30, July 1959, p. 1022-1038.

**12175 Thermosonics.** Recent developments in the subject have been briefly described. ***S. Parthasarathy.*** *Journal of Scientific and Industrial Research*, v. 18A, Jan. 1959, p. 13-16.

**12176 Liquid Helium.** Purpose is to provide a detailed survey of the experimental results and to present an exposition of the current state of the theory, with the emphasis being placed on physical significance rather than on mathematical details. ***K. R. Atkins.*** 312 pp. 1959. Cambridge University Press, New York. (QC284 At52L)

**12177* Electron Beams—New Technique for Welding.** The process operates in a high vacuum and the heat for welding is produced by bombarding the surface of the workpiece with a concentrated beam of fast moving electrons. ***George Burton and R. L. Matchett.*** *Metalworking Production*, v. 103, no. 21, May 22, 1959, p. 901-904.

**12178 Gravity Research and Theory. II. Intermediary Field Theories.** ***A. R. Weyl.*** *Missile Design & Development*, v. 5, July 1959, p. 28-31.

**12179 Initiation of Thermal Reactions by the Flash Illumination of Absorbing Bodies.** Experiments demonstrate the applicability of rapid heating by flash illumination of absorbers of small dimensions. ***J. L. Lundberg and L. S. Nelson.*** *Nature*, v. 183, June 6, 1959, p. 1560-1562.

**12180 The Paramagnetic Resonance and Optical Spectra of Some Ions in Cubic Crystalline Fields.** Shows that paramagnetic resonance is a very powerful tool for examining the lowest energy levels. ***W. Low.*** *New York Academy of Sciences, Annals*, v. 72, art. 2, Mar. 17, 1958, p. 71-126. (Q11 N49a Contin.)

**12181 Measurement of the Polarization of D-D Neutrons by a Solenoid.** A solenoid is described which turns the polarization vector of D-D neutrons over $+90°$ or $-90°$, while the detectors remain in a fixed position. ***P. S. Dubbeldam, C. C. Jonker, and F. J. Heemskerk.*** *Nuclear Instruments and Methods*, v. 4, May 1959, p. 234-238.

**12182 Measurement of Surface Density of Thin Foils.** A $Po^{210}$ alpha source is used to measure the surface density of thin foils with a resolution of approximately $1\mu g/cm^2$. The mass stopping power of Al, Ni, Ag, and Au relative to air, at an alpha energy of 3.72 and 4.33 MeV is reported. ***K. Ramaratanam and D. I. Porat.*** *Nuclear Instruments and Methods*, v. 4, May 1959, p. 239-242.

**12183* Classical and Quantal Flux in the Optical Model.** Concludes that the probability of a particle appearing at a point in the nucleus is, in general, not uniquely connected with the corresponding probability of finding it at a point outside, as is implied by a ray calculation. The disturbance at any interior point is influenced by several partial waves. However, a classical flux calculation is sufficiently accurate to be useful in certain applications. ***R. M. Eisberg, I. E. McCarthy, and R. A. Spurrier.*** *Nuclear Physics*, v. 10, no. 5, Apr. 1959, p. 571-582.

**12184 Thermionic Converters.** The thermionic principle, electrode work functions, converter efficiency, reducing space charge, voltage step-up, practical converter design are discussed. Combined with nuclear fuels, they offer exciting possibilities. ***Karl G. Hernqvist.*** *Nucleonics*, v. 17, July 1959, p. 49-53.

**12185 Optical Materials for Infrared Instrumentation.** Fifty materials, useful in optical instrumentation in the infrared portion of the electromagnetic spectrum are described and compared. Its optical, chemical, thermal, and mechanical properties are given. ***Stanley S. Ballard, Kathryn A. McCarthy, and William L. Wolfe.*** 114 pp. 1959. The University of Michigan, Ann Arbor. (QC371 MS8.18s Over.)

**12186 Unit Magnification Optical System Without Seidel Aberrations.** A method using this system for reproducing photographically small groups of lines with a spacing of 6000 lines/in. is also described. ***J. Dyson.*** *Optical Society of America, Journal*, v. 49, July 1959, p. 713-716.

**12187 New Analysis of the Polarization of Radiation and the Faraday Effect in Terms of Complex Vectors.** ***K. C. Westfold.*** *Optical Society of America, Journal*, v. 49, July 1959, p. 717-723.

**12188* Spectral Emissivity of Solids in the Infrared at Low Temperatures.** Two methods are developed for measuring low-temperature spectral emissivities. ***Dwight Weber.*** *Optical Society of America, Journal*, v. 49, Aug. 1959, p. 815-820.

**12189 Quantum Statistics of Interacting Particles. II. Cluster Integral Development of Transport Coefficients.** ***Elliott W. Montroll and John C. Ward.*** *Physica*, v. 25, June 1959, p. 423-443.

**12190 Van der Waals Forces and Fluctuation Phenomena.** An expression is given for the attraction between two electrically neutral systems, each consisting of electric point charges which move at random inside spherical volumes. ***M. J. Sparnaay.*** *Physica*, v. 25, June 1959, p. 444-454.

**12191 On the Calculation of the Partition Function of a Ferromagnetic Crystal.** ***W. Opechowski.*** *Physica*, v. 25, June 1959, p. 476-486.

**12192 Nature and Role of Ionizing Potential Space Waves in Glow-to-Arc Transitions.** The transition was initiated by a burst of electrons from the cathode yielding a cathode current increase to several amperes in $\sim$ (2 to 10) x $10^{-9}$ second. This burst sends a luminous pip or pulse to the anode at velocities varying from 5 x $10^8$ to 8 x $10^8$ cm/sec, depending on pressure, voltage, and gas. The luminous pip, and to a less clearly defined degree the return plasma front, are accompanied by potential space waves which can be established by cross-plots yielding luminosity and potential distributions across the tube at various times. ***Russell George Westberg.*** *Physical Review*, v. 114, ser. 2, no. 1, Apr. 1, 1959, p. 1-17.

**12193 Excluded-Volume Problem and the Ising Model of Ferromagnetism.** Systematic methods are presented for the construction of rigorous lower bounds to the limit $\mu = \lim_{n\to\infty} (C_n+1/C_n)$. In this way Temperley's conjecture that $\mu = \coth(J/kTc)$, where $Tc$ is the Curie temperature of the corresponding Ising-model ferromagnet, is disproved. The series $c_n$ for various two- and three-dimensional lattices have been enumerated exactly for values of $n$ from 10 to 20. ***Michael E. Fisher and M. F. Sykes.*** *Physical Review*, v. 114, ser. 2, no. 1, Apr. 1, 1959, p. 45-58.

**12194 Excitation of Luminescent Materials by Ionizing Radiation.** For the three types of irradiation used, it was found that the effective volumes of these channels of excitation are proportional to the amount of energy transferred to the phosphor by each ionizing particle and that the ratio between the initial and final values of the light emission is almost independent of the mode of excitation. This implies that the excited electrons diffuse out from the path of the ionizing particle until they are stopped by traps. ***H. Kallmann and J. Dresner.*** *Physical Review*, v. 114, ser. 2, no. 1, Apr. 1, 1959, p. 71-79.

**12195 Theory of Optical Magneto-Absorpton Effects in Semiconductors.** A detailed treatment of the direct transition in germanium is given in which account is taken of the change in curvature of the bands away from k = O and the results are in good agreement with the experimental measurements of Zwerdling, Lax, Roth, and Button. The k = O conduction band mass is found to agree with predictions based on cyclotron resonance in the valence band. ***Laura M. Roth, Benjamin Lax, and Solomon Zwerdling.*** *Physical Review*, v. 114, ser. 2, no. 1, Apr. 1, 1959, p. 90-104.

**12196 Light-Particle Spectra From the Nitrogen Bombardment of Oxygen.** It was found that the angular distributions of protons are reasonably isotropic whereas $\alpha$ particles are peaked in the forward direction. The energy distributions at various angles were compared with the predictions of a simple level density formula $\omega = C \exp[2(aE)^{1/2}]$. The constant $a$ was found to be $a = 2.5 \pm 0.2$ from proton spectra, $a = 1.3 \pm 0.2$ from $\alpha$-particle spectra at all angles measured. The energy spectrum of deuterons was measured at 15 deg. and a value of $a = 1.8 \pm 0.3$ was found. ***M. L. Halbert and A. Zucker.*** *Physical Review*, v. 114, ser. 2, no. 1, Apr. 1, 1959, p. 132-136.

**12197 Kinetic Equation for a Plasma With Unsteady Correlations.** Derived in the form of a generalized Fokker-Planck equation, by considering unsteady correlations, including non-Markovian and nonlinear behavior. ***C. M. Tchen.*** *Physical Review*, v. 114, ser. 2, no. 2, Apr. 15, 1959, p. 394-411.

**12198 Ultrasonic Attenuation by Electrons in Metals.** Discussed for arbitrary frequency and band structure. Applied to the cases of a metal with a spherical energy surface and a semimetal with electrons in two "valleys". ***Eugene I. Blount.*** *Physical Review*, v. 114, ser. 2, no. 2, Apr. 15, 1959, p. 418-436.

**12199 Interaction of Charged Particles With a Degenerate Fermi-Dirac Electron Gas.** Expressions for the self-energy and interaction probability are given. Numerical results for the interaction probability in a particular case are presented. ***R. H. Ritchie.*** *Physical Review*, v. 114, ser. 2, no. 3, May 1, 1959, p. 644-654.

**12200 Optical Properties of Tellurium and Selenium.** Investigated at wavelengths extending from the intrinsic absorption edge to about 152 microns using polarized radiation. Includes refractive indices, temperature shift, pressure shift, and lattice absorption bands. ***Robert S. Caldwell and H. Y. Fan.*** *Physical Review*, v. 114, ser. 2, no. 3, May 1, 1959, p. 664-675.

**12201 Hot-Electron Behavior in Germanium Under the Influence of a Magnetic Field.** The theory in many-valley semiconductors based upon the individual ellipsoidal energy surface model is extended to the circumstance of a superposed magnetic field B. ***Louis Gold.*** *Physical Review*, v. 114, ser. 2, no. 3, May 1, 1959, p. 691-704.

**12202 Antiferromagnetic Resonance in $MnF_2$.** Antiferromagnetic resonance frequency measurements were made on single-crystal slabs of $MnF_2$ in the frequency range 96 to 247.2 kMc/sec and at temperatures ranging from 4.2 K to 64 K. ***Fred M. Johnson and Arthur H. Nethercot, Jr.*** *Physical Review*, v. 114, ser. 2, no. 3, May 1, 1959, p. 705-716.

**12203 Plasma Pinch Effects in Indium Antimonide.** Observed effects at 77 K in high electric fields indicated the presence of pinching effects in a solid. ***M. Glicksman and M. C. Steele.*** *Physical Review Letters*, v. 2, no. 11, June 1, 1959, p. 461-463.

**12204* Possibility of Production of Negative Temperature in Gas Discharges.** ***A. Javan.*** *Physical Review Letters*, v. 3, no. 2, July 15, 1959, p. 87-89.

**12205* On the Diamagnetism of Graphite. I. Energy Levels of $\pi$-electrons.** The energy levels of the conduction electrons in graphite, in the presence of a magnetic field, are calculated by the method of the tight binding approximation, taking into account the effect of band-to-band transitions which is not included in the Landau-Peierls treatment. ***Hisanao Sato.*** *Physical Society of Japan, Journal*, v. 14, May 1959, p. 609-617.

**12206* Thermoelectric Power of AgCl.** ***Yasumasa Susuki, Shigeaki Endō, and Eijirō Haga.*** *Physical Society of Japan, Journal*, v. 14, June 1959, p. 729-731.

**12207 On the Inertial-Electrostatic Confinement of a Plasma.** A system, in which electrons are projected radially inwards from a spherical surface, has been proposed for the confinement of a plasma at thermonuclear temperatures. The equilibrium, economics, and stability of such a system are discussed theoretically. ***William C. Elmore, James L. Tuck, and Kenneth M. Watson.*** *Physics of Fluids*, v. 2, no. 3, May-June 1959, p. 239-246.

**12208* The Application of the Method of Accumulation on Photo-Electric Registration of Time Dependent Spectra of Luminous Flash.** The method of accumulation of the impulse signal can be used for the increase of the spectral and time-dependent solutions, which provides the possibility of reducing the fluctuating distortions of registration of time-dependent spectra of flash in cases of periodically repeated signals. (*In Russian.*) Primenenie metoda nakopleniia pri fotoelektricheskoĭ registratsii vremennykh spektrov svetovykh vspyshek. ***B. A. Ermakov and A. A. Mak.*** *Pribory i Tekhnika Eksperimenta*, 1959, no. 3, May-June, p. 94-97.

**12209* The Zero Modulation Method on Photometric Measurements.** The requirements for the construction of a modulator for the purposes of a maximum preciseness of comparison of two light values are discussed. Some new modulation systems are described. (*In Russian.*) O nulevom moduliatsionnom metode pri fotometricheskikh izmereniiakh. ***V. A. Kovalevskiĭ.*** *Pribory i Tekhnika Eksperimenta*, 1959, no. 3, May-June, p. 98-102.

**12210 Acoustoelasticity From Ultrasonics. A New Stress-Analysis Technique.** Polarized high-frequency sound waves checking for residual stresses. ***R. W. Benson and V. J. Raelson.*** *Product Engineering*, v. 30, no. 29, July 20, 1959, p. 56-59.

**12211 Progress in Crystal Physics. v. I. Thermal, Elastic and Optical Properties.** Includes thermal expansion and conductivity, Faraday effect in diamagnetic crystals, dielectric properties of ionic crystals, and thermo-optic behavior. ***R. S. Krishnan.*** v. I. 198 pp. 1958. S. Viswanathan, Central Art Press, Chetput, Madras, S. India. (QD931 K89p)

**12212 Reports on Progress in Physics.** Fourteen reviews on such topics as quantum mechanics in theoretical chemistry, vacuum technology, relativity, double beta decay, paramagnetic resonance data, invariance in elementary particle physics, and experimental work with $^3$He. ***A. C. Stickland, editor.*** v. XXII. 634 pp. 1959. The Physical Society, London. (QC3 P56r Vis.)

**12213 The Theory of a Fermi Liquid (The Properties of Liquid $^3$He at Low Temperatures).** ***A. A. Abrikosov and I. M. Khalatnikov.*** (Translated from the Russian by M. G. Priestley.) Paper from "Reports on Progress in Physics", v. XXII. p. 329-367, 1959. The Physical Society, London. (QC3 P56r Vis.)

**12214 Experimental Work With $^3$He.** Methods of separation; determination of properties; cryostats with $^3$He; production of low temperatures by crystallization of $^3$He. ***V. P. Peshkov and K. N. Zinov'eva.*** Paper from "Reports on Progress in Physics", v. XXII. p. 504-561, 1959. The Physical Society, London. (QC3 P56r Vis.)

**12215 Cooperative Magnetism in Oxide Structures. II. Ferrimagnetism.** The ferrimagnetic properties of certain oxides which crystallize in the spinel, magnetoplumbite, garnet and other structures are discussed in terms of indirect magnetic exchange interactions. ***L. C. F. Blackman.*** *Research*, v. 12, June 1959, p. 218-225.

**12216* Investigation of the Light Transmission in Haze and Fog.** An optical determination of transmission factors in haze and fog for various wavelengths is intended and their calculation through the simultaneous specification of atmospheric constitution is reported. The first part describes the spectrometer associated with a receiver consisting of a thermopile designed for the range 0.3 to 13 $\mu$ and giving the transmission factor in direct value. The second part describes the methods used to get an absolute granulometric measurement of scattering particles in suspension. (*In French.*) Recherches sur la transmission de la lumière par la brume et par le brouillard. ***Albert Arnulf, Jean Bricard, Émile Curé, and Claude Veret.*** *Revue d'Optique Théorique et Instrumentale*, v. 38, no. 3, Mar. 1959, p. 105-133.

**12217 Pressure Broadening Studies on Vibration-Rotation Bands. I. The Determination of Line Widths. II. The Effective Collision Diameters.** ***D. R. Eaton and H. W. Thompson.*** *Royal Society, Proceedings*, v. 251, ser. A, June 23, 1959, p. 458-485.

**12218 The Ultra-Violet Spectra of HF and DF.** ***J. W. C. Johns and R. F. Barrow.*** *Royal Society, Proceedings*, v. 251, ser. A, June 23, 1959, p. 504-518.

**12219 Thermodynamic and Transport Properties of Gases, Liquids and Solids.** Papers presented at the Symposium on Thermal Properties sponsored by The American Society of Mechanical Engineers, held February 23-26, 1959, at Purdue University, Lafayette, Indiana. Includes papers on PVT data and equation of state, thermodynamic properties of B compounds, and high temperature transport properties of metals and ceramics. 472 pp. 1959. McGraw-Hill, New York. (TP242 Sy68t Over.)

**12220 Studies in the Reactions of High Energy Atoms and Molecules.** Presents a theory relating the lifetimes of light excited molecules to the wavelength of the exciting light and to the temperature. Measurements of reaction products from the flash photolysis of acetone are reported for various acetone pressure temperatures, light intensities, wavelengths, and varying pressures of added O, biacetyl, and some hydrocarbons. ***R. A. Marcus.*** *U. S. Air Force, Wright Air Development Center, WADC Technical Report* 59-24, Jan. 1959, 30 pp. (TL507 Un3.18w Vis.)

**12221 Summaries of Physical Research in Physics and Mathematics.** Provides a picture of "off-site" research activities in high energy physics, nuclear structure and neutron physics, extra-nuclear properties of matter, design and development of research devices, physical methods of isotope separation, and mathematical research and computer development. *U. S. Atomic Energy Commission, TID*-4005, (Pts. 3 & 4), May 1959, 106 pp. (UF767 Un3.ti Contin.)

**12222* Kinetics of F-Center Formation on Radiation With Electrons.** Monocrystals and condensed LiF, NaF and NaCl layers were radiated with 5 kV electrons at 90 K. It is possible to trace the formation of F-centers as a function of the

absorbed energy of electrons by optical measurement of the absorption. (*In German.*) Zur Kinetik der F-Zentrenbildung bei Elektronenbestrahlung. ***Fred Fischer.*** *Zeitschrift für Physik*, v. 154, no. 5, 1959, p. 534-552.

**12223* Calculation of the Free Energy of Crystals With Dislocations.** The free energy is given by the sum of $\phi_0 + F_a$ for the harmonic and as well for the quasi-harmonic approximate equation. For the structure of the dislocation a plausible physical relationship is presumed with a number of free parameters; the free energy is calculated dependent on these parameters, whereby the optimum values of these parameters are determined by variation of F. (*In German.*) Die Berechnung der freien Energie von Kristallen mit Fehlstellen. ***K. Fischer.*** *Zeitschrift für Physik*, v. 155, no. 1, 1959, p. 59-68.

**12224* Effects of the Field Emission on the Distribution of Intensive Fields in Solids.** Investigation of the kinetics of the phenomena occurring in an inhomogeneous field distribution in solid dielectrics and semiconductors. In addition to the ionization of the centers of disturbance, there is an important field emission from the cathode. The stationary case for the dielectric was studied and solved. (*In German.*) Einfluss der Feldemission auf die Verteilung starker Felder in festen Körpern. ***E. I. Adirowitsch.*** *Zeitschrift für Physik*, v. 155, no. 2, 1959, p. 195-205.

**12225* Spectroscopic Investigation of Powerful Pulsed Discharges in Hydrogen. III. Determination of the Parameters of a High Temperature Plasma.** It is shown that at the moment of maximal constriction the density of charged particles at the axis of the discharge is 35-40 times greater than the initial density of the neutral atoms. The ion temperature in this case attains a value of 1-2 million degrees. (*In Russian.*) Spektroskopicheskie issledovaniia moshchnogo impul'snogo razriada v vodorode. III. Opredelenie parametrov vysokotemperaturnoĭ plazmy. ***S. Iu. Luk'ianov and V. I. Sinitsyn.*** *Zhurnal Eksperimental'noĭ i Teoreticheskoĭ Fiziki*, v. 36, no. 6, June 1959, p. 1621-1624.

**12226* On the Microscopic Deduction of the Ginzburg-Landau Equations in the Theory of Superconductivity.** It is shown that the phenomenological Ginzburg-Landau equations are valid in superconductivity theory in the London temperature range near $T_c$. A doubled electron charge, however, is involved in the theory, this being related to the physical meaning of $\psi(x)$ as the wave function of Cooper pairs. The constant $x$ is found to be small. (*In Russian.*) Mikroskopicheskiĭ vyvod uravneniĭ ginzburga-landau v teorii sverkhprovodimosti. ***L. P. Gor'kov.*** *Zhurnal Eksperimental'noĭ i Teoreticheskoĭ Fiziki*, v. 36, no. 6, June 1959, p. 1918-1923.

## PLASTICS

**12227 The Molecular Structure of Polyethylene. X. Optical Studies of Crosslinked Networks.** ***W. M. D. Bryant, F. W. Billmeyer, Jr., L. T. Muus, J. T. Atkins, and J. E. Eldridge.*** *American Chemical Society, Journal*, v. 81, July 5, 1959, p. 3219-3223.

**12228* Epoxy Resins in Glass Cloth Laminates for Tooling.** Jigs, fixtures, and models; press tools and heated and unheated tools. ***P. A. Dunn and E. M. White.*** *Applied Plastics*, v. 2, June 1959, p. 51 + 6 pages.

**12229 Terylene Polyester Fibre as a Resin Reinforcement.** Advantages of terylene polyester fiber in applications such as electrical laminates, chemical plant and general laminate end uses where failure can occur due to the effect of moisture, abrasion, and impact. ***W. Glen.*** *British Plastics*, v. 32, June 1959, p. 273 + 4 pages.

**12230 The Influence of Chemical Structure Upon the Physical Properties of Polymers of the Lower Ring-Alkylated Styrenes.** ***T. E. Davies.*** *British Plastics*, v. 32, June 1959, p. 283-285.

**12231 The Mechanisms of Inhibition and Retardation in Radical Polymerizations. V. The Effects of Picric Acid and *m*-Dinitrobenzene on the Sensitized Polymerization of Styrene.** Effects of the nitro-compounds on the average number of initiator fragments in each polymer molecule were studied by using labelled initiator. A reaction scheme is suggested. ***J. C. Bevington and N. A. Ghanem.*** *Chemical Society, Journal*, 1959, June, p. 2071-2075.

**12232* Influence of Hydrogen on the Anionic Coordinated Polymerization of Propylene and Ethylene.** Kinetic study of the polymerization in the presence of H, and the analysis of terminal groups indicate that H causes the hydrogenolysis of bonds existing between catalyst and growing polymeric chains. (*In Italian.*) Influenza dell'idrogeno sulla polimerizzazione anionica coordinata del propilene e dell'etilene. ***G. Natta, G. Mazzanti, P. Longi, and F. Bernardini.*** *Chimica e l'Industria*, v. 41, June 1959, p. 519-526.

**12233* Stereospecific Polymerizations of Conjugated Diolefins. IV. Preparation of 1,2 Syndiotactic Polybutadiene.** Using soluble aluminum triethyl-vanadium triacetylacetonate catalysts, crystalline 1,2-polybutadienes having syndiotactic structure were obtained. Aged catalysts give products richer of crystalline fraction than fresh catalysts. (*In Italian.*) Polimerizzazioni stereospecifiche di diolefine coniugate. IV. Preparazione del polibutadiene 1,2 sindiotattico. ***G. Natta, L. Porri, G. Zanini, and L. Fiore.*** *Chimica e l'Industria*, v. 41, June 1959, p. 526-533.

**12234* Effect of Various Detergents and Mechanical Stress on Plastic Utensils.** Effect of various washing agents at different temperatures on common plastic utensils made from four different types of synthetic resins. (*In German.*) Verhalten von Kunstharz-Geschirr bei Einwirkung verschiedener Spülmittel und bei mechanischer Beanspruchung durch wiederholten Gebrauch. ***W. Kling, H. Mahl, and M. Nolte.*** *Fette, Seifen, Anstrichmittel*, v. 61, no. 5, May 1959, p. 377-380.

**12235* Plasticizers for Polyvinyl Chloride From Refuse of Chemical Products.** On the basis of wastes from products of organic synthesis, esters were obtained which plasticize polyvinyl chloride, easily combine with it, and are more effective than dibutyl phthalate. The plasticizers obtained should be tested under working conditions. (*In Russian.*) Plastifikatory dlia polivinilkhlorida iz otkhodov khimicheskikh proizvodstv. ***K. V. Borisova, N. G. Ovechenko, T. V. Smirnova, E. M. Levasheva, and I. Nad'.*** *Izvestiia Vysshikh Uchebnykh Zavedeniĭ, Tekhnologiia Legkoĭ Promyshlennosti*, 1959, no. 1, p. 57-61.

**12236 Polymerization Reactions of Itaconic Acid and Some of Its Derivatives.** Homopolymerization of itaconic acid and dimethyl, diethyl, and di-*n*-butyl itaconate. ***C. S. Marvel and Thomas H. Shepherd.*** *Journal of Organic Chemistry*, v. 24, May 1959, p. 599-605.

**12237* Thermal Degradation of Polymers at Low Rates.** Distortion of rate curves has been largely overcome by using a new apparatus, based on an electronic balance, in which the degradation of the specimen is carried out at very low rates. ***Samuel L. Madorsky.*** *Journal of Research, National Bureau of Standards*, v. 62, no. 6, June 1959, p. 219-228.

**12238* Shrinkage and Post-Shrinkage of Melamine Molding Compounds.** Aminoplastic molding compounds in general, and melamine compounds in particular, show special characteristics in their shrinkage and post-shrinkage behavior compared with phenolic materials. (*In German.*) Schwindung und Nachschwindung von Melaminharzpressmassen. ***W. Bauer and W. Gruber.*** *Kunststoffe*, v. 49, June 1959, p. 297-300.

**12239 Updating the Butyrates.** Review covers properties, applications, and design tips. ***Roy O. Hill.*** *Machine Design*, v. 31, July 9, 1959, p. 141-143.

**12240 Polyethylene Copolymer Is Tough at Low Temperatures.** DPD-7365 is a newly developed general purpose, injection molding grade of polyethylene copolymer which is said to have outstanding low temperature toughness and a flex life five times longer than polyethylene injection molding materials of similar plastic flow. *Materials in Design Engineering*, v. 50, July 1959, p. 137-138.

**12241 Polymer-Coated Polystyrene.** Use of 0.1-mil coating is shown to reduce transmission of water vapor and gas in film and sheet, while improving resistance to abrasion and fogging. ***H. A. Scopp and S. Black.*** *Modern Packaging*, v. 32, no. 11, July 1959, p. 116-118.

**12242 Effect of Radiation on Plastic Films.** Analysis of various films exposed to gamma radiation as used in the sterilization of packaged foods shows relationships between chemical structure and stability in such use. ***Charles F. Bersch, Robert R. Stromberg, and Bernard G. Achhammer.*** *Modern Packaging*, v. 32, no. 12, Aug. 1959, p. 117 + 6 pages.

**12243 Polyvinyl Fluoride Film.** Teslar polyvinyl fluoride (PVF) film is the first flexible plastic film available in the lower price range to offer inherent weatherability, coupled with outstanding chemical resistance and toughness. ***Verne L. Simril and Barbara A. Curry.*** *Modern Plastics*, v. 36, no. 11, July 1959, p. 121 + 4 pages.

**12244 Organosol Formulations for Stir-In Dispersion-Type PVC Resins.** Basic rules and considerations for the organosol formulator in a relatively new field where little published information is available. ***Arnold C. Werner.*** *Modern Plastics*, v. 36, no. 11, July 1959, p. 126 + 9 pages.

**12245 Direct Examination of the Degradation of High Polymers by Gas Chromatography.** ***R. S. Lehrle and J. C. Robb.*** *Nature*, v. 183, June 13, 1959, p. 1671.

**12246* Effect of Molecular Constitution of Polyesters on Steam Resistance of Polyester-Styrene Copolymers.** This investigation explored the hope that some compositions of styrene-polyester copolymers might have saponification rates sufficiently slow to allow for their use in products which must withstand steam at sterilization temperatures. ***Edward G. Bell and Edward G. Bobalek.*** *Official Digest*, v. 31, July 1959, p. 878-898.

**12247* Problems of Strength of Glass-Fiber Reinforced Plastics Materials.** (*In German.*) Festigkeitsprobleme bei glasfaserverstärkten Plastwerkstoffen. ***K. G. Reinhardt.*** *Plaste und Kautschuk*, v. 6, May 1959, p. 203 + 9 pages.

**12248* Molded Polystyrene Insulation.** "Uni-Crest" insulates and adds unit strength to refrigerated merchandise. *Plastics Industry*, v. 17, July 1959, p. 24.

**12249* Rigid Urethane Foams.** Comprehensive review covering basic chemistry, formulation, preparation, chemical and physical properties, and applications. ***Antoine Khawam.*** *Plastics Technology*, v. 5, June 1959, p. 31 + 5 pages.

**12250* Some Tensile Properties of Cellulose Acetate Butyrate.** Test results are given for seven decades of tensile stress. ***R. E. Ely.*** *Plastics Technology*, v. 5, June 1959, p. 36-38.

**12251* Factors Affecting Durability of Glass-Reinforced Polyester Plastics.** Properties of polyester resins can be related to their performance in glass-reinforced plastics. ***A. L. Smith and J. R. Lowry.*** *Plastics Technology*, v. 5, June 1959, p. 42 + 7 pages.

**12252* Use of Clays in Vinyl Compounds.** How clays are used in vinyl electrical and mechanical goods, and as coatings in paste applications. ***E. W. Schwartz.*** *Plastics Technology*, v. 5, July 1959, p. 31 + 5 pages.

**12253 Polymer Reviews. v. II. Linear and Stereoregular Addition Polymers: Polymerization With Controlled Propagation.** Adsorption on surfaces and complex formation, requirements for stereospecific polymerization, structure of olefin polymers in the solid state, solution properties of linear polyethylenes and isotactic polymers, fluid-bed processes, fixed-bed processes, polymerization of olefin oxides, and physical properties of olefin polymers. ***Norman G. Gaylord and Herman F. Mark.*** 571 pp. 1959. Interscience Publishers, New York. (QD471 G25L)

**12254* Barium-Cadmium Stabilization of PVC.** Barium-cadmium stabilizers have been developed to a point where they can meet almost any vinyl processing or end-use requirement. ***Norman L. Perry.*** *Rubber Age*, v. 85, no. 3, June 1959, p. 449-452.

**12255 An Introduction to Plastics.** This includes 28 concise articles giving basic information on polyolefines, styrene polymers, vinyl resins, nylon and fluorine plastics, thermosetting resins, polyurethanes, silicones, pigments, processing, and plastics applications. *Rubber and Plastics Age*, v. 40, June 1959, p. 499 + 63 pages.

**12256* Reinforced Plastics for Rocket Motor Applications.** ***George Epstein and J. C. Wilson.*** *SPE Journal*, v. 15, June 1959, p. 473-479.

**12257* The Comparison of Time Dependent Mechanical Properties of Plastics.** Creep, stress relaxaton, and dynamic properties. ***Bryce Maxwell.*** *SPE Journal*, v. 15, June 1959, p. 480-484.

**12258* Copolymerization of Vinyl Acetate and of Styrene by Means of Benzoyl Peroxide.** It is possible to copolymerize vinyl acetate and styrene when a high amount of benzoyl peroxide is used as an initiator. The conversion into polymers in this case exceeds 50%. The elementary composition of different products obtained and their solubility in some solvents were determined. (*In French.*) Copolymérisation de l'acétate de vinyle et du styrène au moyen de peroxyde de benzoyle. ***Fanny Boyer-Kawenoki.*** *Société Chimique de France, Bulletin*, 1959, no. 5, May, p. 729-732.

**12259* A Study of the Effect of Polymer Crystallization on the Dielectric Losses.** Dielectric constants and tangents of the angle of the dielectric losses have been determined for 12 crystallizing polymers over a wide range of frequencies and temperatures. For the major part of the polymers two types of dielectric losses of a relaxation nature have been revealed, reflecting different types of thermal motion. (*In Russian.*) Issledovanie vliianiia kristallizatsii polimerov na dielektricheskie poteri. ***G. P. Mikhailov and B. I. Sazhin.*** *Vysokomolekuliarnye Soedineniia*, v. 1, no. 1, Jan. 1959, p. 29-35.

**12260* The Catalytic Polymerization of Isoprene by Butyllithium.** Kinetics of polymerization of isoprene by butyllithium in a solution of saturated hydrocarbons were determined at 30, 40, 50, and 55 C. Rate of reaction in the pseudo-steady stage at high catalyst concentrations has been found to be independent of the latter and proportional to the square of the monomer concentration. The value of the molecular weight of the polymers formed is approximately proportional to the ratio of the initial monomer and catalyst concentrations, and the mean numerical and mean weight values of the molecular weights of a single polymer specimen do not markedly differ from each other. (*In Russian.*) Kataliticheskaia polimerizatsiia izoprena butillitiem. ***A. A. Korotkov, N. N. Chesnokova, and L. B. Trukhmanova.*** *Vysokomolekuliarnye Soedineniia*, v. 1, no. 1, Jan. 1959, p. 46-57.

**12261* Emulsion Polymerization Under the Action of γ-Radiation.** The rate of polymerization of styrene and methylmethacrylate under the action of γ-radiation is 2 orders higher and the molecular weights of the polymers are by an order higher than bulk polymerization under the same conditions. The effect is due to increase in rate of initiation (initiation by H and OH radicals) and to a decrease in rate of chain termination reaction in the viscous medium of polymer-monomer particles. (*In Russian.*) Polimerizatsiia v emul'siiakh pod deĭstviem γ-izlucheniia. ***A. P. Mezhirova, et al.*** *Vysokomolekuliarnye Soedineniia*, v. 1, no. 1, Jan. 1959, p. 68-72.

**12262* The Synthesis and Mechanical Properties of Isotactic Polystyrene.** Thermomechanical properties of crystalline and amorphous isotactic polystyrene were investigated and compared with those of ordinary atactic polymer. Vitrification temperature for both types of polymers is the same. Data obtained indicate that in production of articles from a melt of the isotactic polystyrene, subsequent heating to above the vitrification temperature is necessary to increase their heat stability. (*In Russian.*) Sintez i mekhanicheskie svoĭstva izotakticheskogo polistirola. ***V. A. Kargin, V. A. Kabanov, and I. Iu. Marchenko.*** *Vysokomolekuliarnye Soedineniia*, v. 1, no. 1, Jan. 1959, p. 94-102 + 1 plate.

**12263* The Synthesis of Starch and Styrene Graft Copolymers and a Study of Their Properties.** On ozonating aqueous starch suspensions, active peroxide groups are formed on the starch which have been used for initiating styrene

polymerization and for production of starch and styrene graft copolymers. Length of the grafted-on chains of polystyrene is commensurate with that of homopolystyrene, a side product of the reaction. The starch-styrene graft copolymers with different component ratios may under certain circumstances be good emulsifiers for water-oil emulsions. (*In Russian.*) Poluchenie i issledovanie svoĭstv privitykh sopolimerov na osnove krakhmala i stirola. ***V. A. Kargin, P. V. Kozlov, N. A. Plate, and I. I. Konoreva.*** *Vysokomolekuliarnye Soedineniia,* v. 1, no. 1, Jan. 1959, p. 114-122.

**12264* Studies on the Molecular Structure of Synthetic Fibers. XIV. Physico-Chemical and Physico-Mechanical Properties in the Series of Polycapramide-Polyundecanamide Polyamides. XV. Thermochemical Properties of Polycapramide-Polyundecanamide Polymers of the Polyamide Series.** (*In Russian.*) Issledovanie molekuliarnoĭ struktury sinteticheskikh volokon. XIV. Fiziko-khimicheskie i fiziko-mekhanicheskie svoĭstva v riadu poliamidov polikapramid-poliundekanamid. ***H. V. Mikhaĭlov, T. I. Sheĭn, V. O. Gorbacheva, and V. H. Topchibasheva.*** XV. Termokhimicheskie svoĭstva v riadu poliamidov polikapramid-poliundekanamid. ***N. V. Mikhaĭlov and E. Z. Faĭnberg.*** *Vysokomolekuliarnye Soedineniia,* v. 1, no. 2, Feb. 1959, p. 185-190, 201-207.

**12265* On the Temperature Dependence of the Deformaton of Crystalline Polymers.** Study was made of the mechanical properties of polyhexamethyleneadipamide over a wide range of temperatures. Anomalies were found in the temperature dependence of deformability and recrystallization stress in the interval 180-190 C. It has been suggested that the anomalies are associated with kinetics of crystallization and recrystallization of the polymer. (*In Russian.*) K voprosu o temperaturnoĭ zavisimosti deformatsii kristallicheskikh polimerov. ***G. L. Slonimskiĭ and V. A. Ershova.*** *Vysokomolekuliarnye Soedineniia,* v. 1, no. 2, Feb. 1959, p. 240-243.

**12266* The Processing of Chemically Thermosetting Polyethylene.** Principles involved in practical processing of these compounds as they are now known to the wire and cable industry. ***Arthur C. Rowley.*** *Wire and Wire Products,* v. 34, July 1959, p. 838 + 4 pages.

***See also:*** **11240** (Araldite resins); **11610** (plastics markets).

## POLLUTION AND WASTES

**12267* Atmospheric Pollution Control.** A case history of an extensive study beginning with basic determinations of fluoride quantity in materials and waste products from open-hearth furnaces which led to effective control of atmospheric pollution with fluorine. ***W. T. Purvance.*** *Chemical Engineering Progress,* v. 55, July 1959, p. 49-53.

**12268* The Significance of Surface Electric Charge on Algae in Water Purification. *K. J. Ives.*** *Journal of Biochemical and Microbiological Technology and Engineering,* v. 1, no. 1, Feb. 1959, p. 37-47.

**12269* A Review of the Literature of 1958 on Sewage, Waste Treatment, and Water Pollution.** Food processing wastes, dairy wastes, and many other kinds of wastes are discussed. ***H. Heukelekian, et al.*** *Sewage and Industrial Wastes,* v. 31, June 1959, p. 615-661.

**12270* The Effect of Sewage Treatment on Viruses.** Primary treatment and secondary treatment by trickling filters did not reduce the frequency of virus isolations. Effluent from an activated sludge treatment plant did not contain viruses, nor were they found in Imhoff tank or digested sludge. ***Sally Kelly and Wallace W. Sanderson.*** *Sewage and Industrial Wastes,* v. 31, June 1959, p. 683-689.

**12271* A Review of the Literature of 1958 on Sewage, Waste Treatment, and Water Pollution. III.** *Sewage and Industrial Wastes,* v. 31, July 1959, p. 763-803.

***See also:*** **11859** (ventilation of foundries).

## RUBBER AND ELASTOMERS

**12272* Silane Agents Toughen Colored Rubbers.** Data on a technique by which treatment of selected fillers with organochlorosilanes give vulcanizate properties comparable with those of blacks. ***Marvin C. Brooks.*** *Canadian Chemical Processing,* v. 43, July 1959, p. 65 + 2 pages.

**12273* Emulsion Polymerization of Butadiene Using Styrene or Acrylic Nitrile. Influence of Amount of Monomeric Reaction on Rubber Properties of Buna Types S 3 and N.** (*In German.*) Der Einfluss des Monomerenumsatzes auf die Kautschukeigenschaften von Buna S 3 und Buna N. ***P. Herte and W. Hufenreuter.*** *Plaste und Kautschuk,* v. 6, May 1959, p. 231-234.

**12274* The Microbiological Deterioration of Rubber Insulation.** Natural rubber and GR-S insulation are inherently vulnerable to fungus attack unless made sufficiently fungitoxic. The most prevalent is *Spicaria violacea* Abbott. The presence of fungus in insulation lowers the dielectric strength before the filaments have passed completely through the wall of insulation. Stable fungitoxic GR-S compounds have been developed which have invariably maintained normal high insulation resistance during four years in active soil. (*In French.*) La deterioration microbiologique des isolants en caoutchouc. ***John T. Blake, Donald W. Kitchin, and Orson S. Pratt.*** *Revue Generale du Caoutchouc,* v. 36, Apr. 1959, p. 529-536.

**12275* Properties and Performance of Rubber Fillers.** Effects of particle size and shape, surface area, degree of agglomeration and wetting. ***Eli M. Dannenberg.*** *Rubber Age,* v. 85, no. 3, June 1959, p. 431-439.

**12276* O-Rings for Cylinder Liners of Diesel Engines.** Evaluations of various elastomers for this service. ***S. A. Eller and A. A. Stein.*** *Rubber Age,* v. 85, no. 3, June 1959, p. 443-448.

**12277* Drying Black Rubber.** A black rubber drying process has been developed which starts the actual dispersion of the carbon black into the rubber. It takes advantage of the greater efficiency of a rotary drier system and avoids the snowballing effect frequently encountered in the past. ***G. L. Heller, J. W. White, and H. A. Braendle.*** *Rubber Age,* v. 85, no. 4, July 1959, p. 605-610.

**12278* Effects of Ozone on Rubber.** Condensed versions of papers presented at the May meeting of the Rubber Division, ACS: ozone cracking of rubber, ozone resistance of styrene-butadiene rubber at low temperatures, method of screening antiozonants, correlation of ozone chamber and outdoor exposure, antiozonants in road and accelerated tests, resistance of rubber compounds to outdoor and accelerated ozone attack, operation of azone chambers, weather aging of elastomers on military vehicles, ozone resistance of neoprene vulcanizates under flexure. *Rubber Age,* v. 85, no. 4, July 1959, p. 615-623.

**12279* Effect of Highly Aromatic Gasolines on Fuel Hose Compounds.** Using commercial gasolines and specially prepared test fuels of known aromatic content, neoprene, polysulfide, and nitrile rubber hose stocks were subjected to immersion for periods up to 30 days and then tested for volume swell and % retained tensile properties. ***James Meyer and Joseph Taylor.*** *Rubber World,* v. 140, no. 4, July 1959, p. 573-578.

**12280* The Reaction of Tetramethylthiuram Disulfide With Rubber and With Compounds With a Labile Hydrogen Atom.** In the interaction of tetramethylthiuram disulfide (TMTD) with rubber, S and N of the former add to the latter, a maximum being exhibited on the rate curve of S addition. At the same time dimethyldithiocarbamic acid is formed, which in mixtures with ZnO becomes bound in the form of zinc dithiocarbamate or decomposes to $CS_2$ and dimethylamine in mixtures with Mg and Ca oxides and in the absence of metallic oxides. (*In Russian.*) Vzaimodeĭstvie tetrametiltiuramdisul'fida s kauchukom i soedineniiami soderzhashchimi podvizhnyĭ atom vodoroda v molekule. ***B. A. Dogadkin***

*and V. A. Shershnev. Vysokomolekuliarnye Soedineniia,* v. 1, no. 1, Jan. 1959, p. 58-67.

**12281* The Effect of the Chemical Nature of Solvents on the Oxidation of Rubber in Solutions.** Effect of chemical nature of solvents on oxidation of rubber solutions was investigated. Oxidation rate increases in the order: benzene <toluene <xylene <ethylbenzene <isopropylbenzene <tetralene. The solvents were found to take part in development of a radical chain mechanism of rubber oxidation. The more labile the H atom in the solvent molecule, the easier the chain propagation reaction and the greater the oxidation rate. (*In Russian.*) Vliianie khimicheskoĭ prirody rastvoriteleĭ na okislenie kauchuka v rastvorakh. ***T. G. Degteva and A. S. Kuz'minskiĭ.*** *Vysokomolekuliarnye Soedineniia,* v. 1, no. 1, Jan. 1959, p. 73-83.

**12282* The Interaction of Phenyl-β-naphthylamine With Benzoyl Peroxide and the Effect of O-Benzoyl-N-phenyl-N-β-naphthyl-hydroxylamine on the Oxidation of Rubber.** On interaction of benzoyl peroxide and phenyl-β-naphthylamine in ratios of 1:1 and 2:1 in ether solution, benzoic acid and O-benzoyl-*N*-phenyl-*N*-β-naphthyl-hydroxylamine are formed. The latter in optimal concentration is a strong inhibitor of oxidation, whereas in weak concentrations it accelerates this process. (*In Russian.*) Vzaimodeĭstvie fenil-β-naftilamina s perekis'iu benzoila i vliianie O-benzoil-*N*-fenil-*N*-β-naftilgidroksilamina na okislenie kauchuka. ***B. A. Dogadkin and E. N. Beliaeva.*** *Vysokomolekuliarnye Soedineniia,* v. 1, no. 1, Jan. 1959, p. 123-125.

**12283* The Action of Double Systems of Vulcanization Accelerators.** In the joint utilization of vulcanization accelerators, depending upon their chemical structure, there takes place either a mutual activation or activation of one of them, or else their additive action. In the interaction of di-2-benzothiazyldisulfide with N-cyclohexyl-2-benzothiazol sulfenamide in the presence of rubber, the formation of 2-mercaptobenzothiazole takes place in amounts considerably larger than are observed on separate action of the accelerators. (*In Russian.*) Deĭstvie dvoĭnykh sistem uskoriteleĭ vulkanizatsii. ***B. A. Dogadkin M. S. Fel'dshtein, and E. N. Beliaeva.*** Vysokomolekuliarnye Soedineniia, v. 1, no. 2, Feb. 1959, p. 254-264.

*See also:* **11297** (rubber analysis); **11423** (rubber additives).

## SPACE HEATING AND CONDITIONING

**12284* Suppression of Oscillations in Gas-Fired Residential Heating Equipment.** Techniques for the suppression of oscillations in gas-fired heating equipment utilizing burners of both single- and mutliple-port type. ***C. F. Speich and A. A. Putnam.*** *ASHRAE Journal,* v. 1, Aug. 1959, p. 41-45.

**12285* A Primer of Thermoelectric Refrigeration.** Considering five major aspects of thermoelectric refrigeration, this paper first presents the advantages of the system. It includes a non-technical explanation of the thermoelectric process with analogies to well-known principles of mechanical refrigeration. Moving further into the subject, design and manufacturing problems are discussed, and economic considerations are analyzed. ***A. Staebler.*** *ASHRAE Journal,* v. 1, Aug. 1959, p. 60-65.

**12286* Solar Space Cooling.** Design consideration and test results. ***R. Chung, G. O. G. Löf, and J. A. Duffie.*** *Air Conditioning, Heating and Ventilating,* v. 56, July 1959, p. 50-53.

**12287* High Temperature Hot Water Systems.** Discusses advantages and disadvantages of the systems. ***R. E. Viles.*** *Australasian Engineer,* 1959, May 7, p. 48-52.

**12288* Electric Heating—a Jet-Age Assist With a Significant Growth Challenge.** This is a digest of the author's paper presented to the 25th Annual Sales Conference, Edison Electric Institute. ***Paul W. Emler.*** *Electric Heat and Airconditioning,* v. 5, no. 3, May-June 1959, p. 9 + 5 pages.

**12289* Mechanical Ventilation Is Helpful.** With a very tight house, it keeps the air fresh. ***Douglas W. Clark.*** *Electric Heat and Airconditioning,* v. 5, no. 3, May-June 1959, p. 36-37.

**12290* Industrial Air Conditioning: How to Prove Dollars-and-Cents Savings.** Factory air conditioning has a potential of more than a million tons of cooling. But unlike residential jobs, industrial installations must be sold on the basis of provable cash savings. This article outlines one procedure for doing so. *Heating & Air Conditioning Contractor,* v. 50, no. 10, July 1959, p. 49-51.

**12291* Air Conditioning in a Trial Setting.** Discusses problems faced in installing air conditioning in the Jefferson County (Ala.) Courthouse. *Heating & Air Conditioning Contractor,* v. 50, no. 10, July 1959, p. 56-59.

**12292 Wide Functional Needs of Orphanage Met by Variety of Heating Methods Installed at Low Cost.** ***Robert S. Glasier.*** *Heating, Piping & Air Conditioning,* v. 31, July 1959, p. 99-103.

**12293 What Central Control for Steam Heating Can and Cannot Do. Weigh Pros and Cons.** Central control for steam heating systems, long a common practice, is being questioned. Speaking up in defense of this type of control, the author shows why the central or zone control is desirable as the basic system, and everything else that is needed depends on the particular job conditions. ***Lewis Smith.*** *Heating, Piping & Air Conditioning,* v. 31, July 1959, p. 112-115.

**12294 Floor Panel Radiant System Solves 5 Heating Problems—in Two Airplane Hangars.** *Heating, Piping & Air Conditioning,* v. 31, July 1959, p. 122.

**12295 Winning the Air Conditioning Odor Fight Round 7: The Knockout Blow.** Discusses ability of the nose to detect and evaluate odors, physical properties of odors themselves, effects that temperature and humidity have on them, and some cures for specific odor problems; another common air conditioning odor source—the cooling coil—and what to do about it. ***Albert B. Hubbard.*** *Heating, Piping & Air Conditioning,* v. 31, July 1959, p. 137-138.

**12296 Submarine Studies Indicate—Airborne Condensation Droplets, Ions May Be Major Health Factors—in Habitability of Closed Spaces.** Studies of the submarine atmosphere, conducted aboard German U-boats during World War II, have established that airborne condensation droplets and ions increase with prolonged submergence. In this third and concluding article, Dr. Schaefer goes into the biological significance of these conditions on humans. ***Karl E. Schaefer.*** *Heating, Piping & Air Conditioning,* v. 31, July 1959, p. 139-140.

**12297* A New Dust Measuring Method.** This measuring method has a great advantage, inasmuch as it permits the precipitation of large quantities of dust without any material pressure rise on the filters and makes them easily accessible for an analysis. (*In German.*) Über eine neue Methode zur Staubmessung. ***A. Winkel.*** *Staub,* v. 19, July 1959, p. 253-255.

**12298* An Air-Conditioner for Investigation of Dust.** An air-conditioner for dust tests, which permits temperature control and the control of the relative air moisture, is described. (*In German.*) Eine Anlage zur Klimatisierung von Luftströmen für Staubuntersuchungen. ***F. Maak and Th. Gast.*** *Staub,* v. 19, July 1959, p. 255-258.

**12299* The Effect of the Air Moisture on the Binding Capacity of Hygroscopic Salts for Coal Dust.** The behavior of Mg chloride and Ca chloride paste layers with relative air moistures between 60 and 90%. (*In German.*) Der Einfluss der Luftfeuchte auf die Bindefähigkeit von hygroskopischen Salzen gegenüber Kohlenstaub. ***H. Meerbach and A. Berner.*** *Staub,* v. 19, July 1959, p. 259-262.

**12300 Symposium on Cleaning of Electronic Device Components and Materials.** Principal concern is with vacuum tube manufacture. 213 pp. 1959. American Society for Testing Materials, Philadelphia, Pa. (TK7870 Am35s)

## TEXTILES, FIBERS, LEATHER, AND PAPER

**12301* A Chrome Alum—Collagen System.** A novel type of tannage with chrome alum is described, in which the acid-binding faculty of the collagen is utilized for the formation of basic chromium sulfate *in situ*. ***K. H. Gustavson.*** *American Leather Chemists Association, Journal,* v. 54, July 1959, p. 390-398.

**12302* Comments on Genetic Variation Within Geographic Ecotypes of Forest Trees and Its Role in Tree Improvement.** The authors agree with other authors that genetic action programs cannot operate at top efficiency until we know more about inheritance in forest trees, but they do not agree that action should be postponed until a vast array of vigorous experiments have been completed. ***John C. Barber and Bruce J. Zobel.*** *Journal of Forestry,* v. 57, June 1959, p. 439-441.

**12303 Studies on the Barks of the Family *Salicaceae*. I. Tremuloidin, a New Glucoside From the Bark of *Populus tremuloides*. Irwin A. Pearl and Stephen F. Darling.** *Journal of Organic Chemistry,* v. 24, June 1959, p. 731-735.

**12304* Mechanical Properties of Wood Fibers.** A technique is described for measuring the tensile mechanical properties of single fibers of wood using a conventional testing machine and small, specially fabricated grips for fixing the ends of the fiber. The existence of a limit of proportionality between stress and strain indicates that the fibers possess viscoelastic characteristics. ***B. A. Jayne.*** *Tappi,* v. 42, June 1959, p. 461-467.

**12305* Structure-Property Relationships in Synthetic Fibers. I. Structure as Revealed by Sonic Observations. II. Elastomeric Condensation Block Copolymers.** I. ***W. Hale Charch and W. W. Moseley, Jr.*** II. ***W. Hale Charch and Joseph C. Shivers.*** *Textile Research Journal,* v. 29, July 1959, p. 525-540.

## WELDING AND JOINING

**12306 Cutting Costs With Adhesive Bonding. II.** Describes in detail how adhesives are used in automotive and aircraft applications, gives pointers on their selection for specific requirements, and analyzes current and future trends in adhesive bonding. ***Andrew W. Shearer.*** *Automotive Industries,* v. 121, no. 2, July 15, 1959, p. 72 + 6 pages.

**12307* Quality Control in Contact Welding of Rollers.** Defects on spots of non-fusion have an appearance either of complete non-melting or of welding with gas inclusions. (*In Russian.*) O kontrole kachestva kontaktnoĭ rolikovoĭ svarki. ***A. A. Trushchenko.*** *Avtomaticheskaia Svarka,* v. 12, no. 6, June 1959, p. 12-21.

**12308* Spectrochemical Determination of Aluminum in Chromo-Nickel Austenite Steels and in Welding Seams.** Possibility of analysis on absolute blackening of the analytical line of Al is shown. The Tesla spark was used as source of light. (*In Russian.*) Spektrokhimicheskoe opredelenie aliuminiia v khromonikelevykh austenitnykh staliakh i svarnykh shvakh. ***E. S. Kudelia.*** *Avtomaticheskaia Svarka,* v. 12, no. 6, June 1959, p. 28-30.

**12309* The Welding of Molybdenum.** Weldability, welding in inert gases, and contact welding are discussed. (*In Russian.*) Svarka molibdena. ***S. M. Gurevich.*** *Avtomaticheskaia Svarka,* v. 12, no. 6, June 1959, p. 36-48.

**12310* The Causes and the Mechanism of Hot Cracks in Welded Seams With a Monophase Austenite Structure.** Cracks originate in a solid phase below the crystallization front. To avoid hot cracks it is recommended to decrease overheating of the liquid welding bath, to modify the crystalline structure, to alloy the metal of the seam with elements decreasing the diffusion mobility of atoms of the basis of the solid solution. (*In Russian.*) Oprichinakh i mekhanizme goriachikh treshchin v svarnykh shvakh s odnofaznoĭ austenitnoĭ strukturoĭ. ***B. A. Movchan.*** *Avtomaticheskaia Svarka,* v. 12, no. 6, June 1959, p. 49-66.

**12311* Calculation of Reactions Between the Molten Pool and Slag From Viewpoint of Molecular and Ionic Theories.** Calculation of the equilibrium stage of reactions on welding can be carried out according to the theory of Schenk, which regards the slag as a molecular solution or according to the ionic theory which regards the slag as an ionic solution. The calculation by the ionic theory is simpler and gives better results. (*In Russian.*) Raschet reaktsiĭ mezhdu naplavlennoĭ vannoĭ i shlakom s tochki zreniia molekuliarnoĭ i ionnoĭ teoriĭ. ***V. A. Lapidus.*** *Avtomaticheskaia Svarka,* v. 12, no. 6, June 1959, p. 67-78.

**12312* Unskilled Men Make Speedy Tack Welds.** High-quality tack welds made by relatively untrained men are replacing spot-welding by skilled operators. ***G. A. dal Molin.*** *Canadian Metalworking,* v. 22, July 1959, p. 36-37.

**12313* Surging Water Tamed by Bush-Country Welding.** A welding job of this size would have its problems anywhere, but when it's deep in the wilderness, special skills are needed for success. ***R. F. Scott and D. J. Nickilo.*** *Canadian Metalworking,* v. 22, July 1959, p. 38 + 2 pages.

**12314 Material and Welding. III. A Handbook of Welding Technique as Applied to the Material Used and Its Requirements.** The following are the main subjects contained in this third volume: new protective gas welding techniques in the case of Cu, C, and V2A steels, the corrosion behavior of welded Al-materials, a literature survey of Ti and its alloys, the basic principles of glass melting, a cutting method with cost reduction of acetylene, an interpretation of common fundamentals in pressure welding and sintering processes, and welding training in Germany. (*In German.*) Werkstoff und Schweissung. III. Handbuch für die Werkstoff und Werkstoffbedingte Verfahrenstechnik der Schweissung. ***Friedrich Erdmann-Jesnitzer.*** 633 pp. 1959. Akademie-Verlag Gmbh, Berlin. (TS227 Er 28w)

**12315 Three Major Types of High Strength Adhesives Approach Bond Strength of Welding, Fastening.** Three major types: their properties, and why their use is growing in metal-to-metal bonding. ***E. F. Hess.*** *Materials in Design Engineering,* v. 50, July 1959, p. 104-107.

**12316* Welding Unusual Metals.** While highly reactive metals require unusual equipment and care to prevent weld contamination, the principles of operation are but extensions of ideas widely used to make sound joints in thin sheets of conventional metals of commerce. ***D. W. Grobecker.*** *Metal Progress,* v. 76, no. 1, July 1959, p. 87-90.

**12317 Welding Process Gives Good Control.** A new welding process, called "Short-Arc" welding has been developed by Linde Company, Division of Union Carbide Corporation. It permits manual and mechanized welding of thin material with excellent control of the weld puddle. *Missiles and Rockets,* v. 5, no. 29, July 13, 1959, p. 29.

**12318* Designing Welded Stiffeners.** *Tool Engineer,* v. 43, no. 1, July 1959, p. 87-88. (Extracted from "Design Ideas No. 21" published by the Lincoln Electric Co., Cleveland, Ohio.)

**12319* Unreasonable Codes Discourage Welded Design.** Unrealistic standards discourage the use of welding in buildings, bridges, and fabrications, hamper the redesign of castings and forgings and prevent savings that could result. ***J. F. Lincoln.*** *Welding Design & Fabrication,* v. 32, July 1959, p. 30-31.

**12320* Joint Design for Automatic Welding Eliminates Cracking and Porosity.** Good joint design and correct welding procedures minimize cracking and porosity in consumable electrode welding a low alloy forged steel to a cast high-temperature alloy. ***A. J. Rosenberg and E. W. Jamison.*** *Welding Design & Fabrication,* v. 32, July 1959, p. 32 + 4 pages.

**12321*** **Composite Welded Design Has Flexibility.** Welding permits using a variety of metals and metal shapes and thicknesses without increasing production costs of ultra-modern light poles. *Welding Design & Fabrication*, v. 32, July 1959, p. 35 + 1 page.

**12322*** **Economics of Welded Fabrication. III. Manufacturing: Joint Design and Standardization.** Weldment design depends on standardization, on joint design and on stresses in parts under load. ***John Mikulak.*** *Welding Design & Fabrication*, v. 32, July 1959, p. 36-39.

**12323*** **Flash Welded Flat Stock Can Be Cold Worked.** Engineered production, selection of proper material, good joint preparation and correct flash welding techniques make possible high volume production of house trailer rims. *Welding Design & Fabrication*, v. 32, July 1959, p. 40-41.

**12324*** **How to Specify Joint Clearance for Brazing Dissimilar Metals.** The accompanying nomograph can help eliminate time-consuming trial-and-error methods usually needed to determine proper joint clearance for brazing dissimilar metals. *Welding Design & Fabrication*, v. 32, July 1959, p. 44 + 1 page.

**12325*** **Know Your Filler Metals. I.** A leading authority gives a useful explanation of filler metal specifications. ***Orville T. Barnett.*** *Welding Design & Fabrication*, v. 32, July 1959, p. 47-48.

**12326*** **Dip Transfer $CO_2$ Welding of Mild and Low Alloy Steels.** New process makes possible economical welding of mild and low alloy steels in all positions. *Welding Design & Fabrication*, v. 32, July 1959, p. 54-57.

**12327*** **"Short-Arc" Welding of Thin Materials.** New inert-gas consumable electrode process permits manual and mechanized welding of thin materials. *Welding Design & Fabrication*, v. 32, July 1959, p. 60-61.

**12328 Welding Provides—The Key for the Door to America's Nuclear Reactors.** *Welding Engineer*, v. 44, Aug. 1959, p. 27-28.

**12329 Techniques for Torch Brazing Aluminum.** When joining Al for particular applications, it may be more advisable to torch braze the components rather than to fusion weld them. ***Howard E. Adkins and Robert A. Ridout.*** *Welding Engineer*, v. 44, Aug. 1959, p. 30-32.

**12330 How to Get the Most From Semiautomatic Welding Machines.** *Welding Engineer*, v. 44, Aug. 1959, p. 33-35.

**12331 Welded Rail, Concrete Ties Win German Approval.** ***Harry J. Miller.*** *Welding Engineer*, v. 44, Aug. 1959, p. 36-37.

**12332 "Welding Figures Prominently in 7-Year Plan".** Translation of the foreword to "Automatic Welding", a Russian publication recently translated by the British Welding Research Association. *Welding Engineer*, v. 44, Aug. 1959, p. 40 + 2 pages.

**12333 American Indians Taking Advantage of Vocational Training Program.** ***Eric Holby.*** *Welding Engineer*, v. 44, Aug. 1959, p. 50-51.

**12334*** **Heat-Extractive Brazed Bimetals Show Promise for Missile and Industrial Applications.** Research program indicates that it is feasible to apply vacuum-brazing techniques to the protection of refractory metals under short-term exposures to temperatures up to and exceeding 3600 F. ***Robert C. Bertossa and Steven Rau.*** *Welding Journal*, v. 38, July 1959, p. 273s-281s.

**12335*** **Certain Structural Properties of Ultrasonic Welds in Aluminum Alloys.** Data presented indicate that ultrasonic welds have higher shear strengths than fusion-type welds in structural Al alloys in thickness up to about 0.071 in.; are reproducible within narrow strength scatter bands; and require less-critical sheet-surface preparation. ***J. Byron Jones and W. C. Potthoff.*** *Welding Journal*, v. 38, July 1959, p. 282s-288s.

**12336*** **An Evaluation of the Diffusion-Bonding Characteristics of Zircaloy-2.** Experiments aimed at joining Zircaloy-2 components by a diffusion-bonding technique show that Cu, Ni, Ni-P, Mn, and Si are the most promising diffuser elements. ***W. Feduska.*** *Welding Journal*, v. 38, July 1959, p. 289s-295s.

**12337*** **Plasma-Energy Transfer in Gas-Shielded Welding Arcs.** Study shows how the variance in the total thermal conductivity of an arc-shielding gas influences the shape of the discharge. ***H. C. Ludwig.*** *Welding Journal*, v. 38, July 1959, p. 296s-300s.

**12338*** **Instantaneous Inspection of Ship Welds With Scattered Gamma Radiation.** Paper reports on present status of filmless technique and describes procedure evolved for utilizing only one side of the ship's hull during testing. ***J. I. Bujes.*** *Welding Journal*, v. 38, July 1959, p. 301s-304s.

**12339*** **Fabrication and Construction of Piping System for the Dresden Nuclear Power Station.** The unique service conditions in the 180,000-kw Commonwealth Edison Dresden Nuclear Power Station near Morris, Ill., required the use of special materials and fabricating procedures in its construction. This paper describes the materials of fabrication, the forming, heat-treating and welding procedures, and special techniques employed in the fabrication and construction of the power-piping system of the plant. ***G. B. Grable and A. M. Croswell.*** *Welding Journal*, v. 38, July 1959, p. 657-664.

**12340*** **The Buffalo Bayou Bridge and Future Long-Span Possibilities.** The three-span (198 ft.-270 ft.-198 ft.) continuous welded-plate girder Buffalo Bayou Bridge in Houston, Tex., incorporates spans which are among the longest in welded construction in this country. ***Charles S. Matlock and Farland C. Bundy.*** *Welding Journal*, v. 38, July 1959, p. 665-671.

**12341*** **Submerged-Arc Welding on the Pipe Line.** Submerged-arc welding is being used currently in the pipe-line industry to "double joint" large-diameter pipe. Double jointing is the art of aligning two joints of pipe and applying a circumferential or girth weld, thus doubling the length of pipe. ***William B. Handwerk.*** *Welding Journal*, v. 38, July 1959, p. 672-675.

**12342*** **New Developments in the Welding of Aluminum.** Aluminum can be expected to find more and more use as a structural material for aircraft, missiles, pressure vessels, and bridges. ***R. L. Hackman.*** *Welding Journal*, v. 38, July 1959, p. 676-684.

***See also:*** **11791** (welded ships); **11800** (intergranular corrosion of welds).

## MISCELLANEOUS

**12343*** **What the Trade Association Should Know About Motivation Research.** ***Bertrand Klass.*** *ASAE Journal*, v. 11, no. 3, July 1959, p. 25-30.

**12344*** **Industry and Education, a Way of Co-Operation.** Discusses management-training programs set up by the Associated Industries of Georgia and the University of Georgia. ***Clifford M. Clarke, Jr.*** *ASAE Journal*, v. 11, no. 3, July 1959, p. 33 + 3 pages.

**12345*** **Today's Research Needs Set at $4 Million a Year.** Battelle specialists stress that gas industry must boost research budget to $6 million annually by 1965 to stay ahead of competition. ***H. A. Eddins.*** *American Gas Association Monthly*, v. 41, nos. 7-8, July-Aug. 1959, p. 14 + 4 pages.

**12346*** **On $\Gamma$-Extensions of Algebraic Number Fields.** Let $p$ be a prime number. We call a Galois extension $L$ of a field $k$ a $\Gamma$-extension when its Galois group is topologically isomorphic with the additive group of $p$-adic integers. Purpose of present

paper is to study arithmetic properties of such a $\Gamma$-extension $L$ over a finite algebraic number field $K$. ***Kenkichi Iwasawa.*** *American Mathematical Society, Bulletin,* v. 65, no. 4, July 1959, p. 183-226.

**12347* Measure Algebras on Abelian Groups.** Describes recent developments in general field of Fourier analysis, illustrating algebraic point of view which has established itself here as well as in most other parts of analysis, and which has been most fruitful in suggesting new and interesting problems. ***Walter Rudin.*** *American Mathematical Society, Bulletin,* v. 65, no. 4, July 1959, p. 227-247.

**12348* On a Generalization of an Inequality of L. V. Kantorovich.** The subject of this paper is the proof of a generalized form of the inequality for linear, bounded and self-adjoint operators in Hilbert space. ***Werner Greub and Werner Rheinboldt.*** *American Mathematical Society, Proceedings,* v. 10, no. 3, June 1959, p. 407-415.

**12349* Almost Periodic Solutions of Second Order Nonlinear Differential Equations With Almost Periodic Forcing.** ***C. E. Langenhop and G. Seifert.*** *American Mathematical Society, Proceedings,* v. 10, no. 3, June 1959, p. 425-432.

**12350* Proximity Maps for Convex Sets.** ***Ward Cheney and Allen A. Goldstein.*** *American Mathematical Society, Proceedings,* v. 10, no. 3, June 1959, p. 448-450.

**12351 In Research, Statistics Is Frequently an Overlooked Tool.** Three keys to satisfactory statistical control which are necessary to ensure that the results of a study can be relied upon are: (1) Proper experimental design, (2) Proper sample size, and (3) Proper evaluation of the data. ***Louis Bromer.*** *American Pharmaceutical Association, Journal (Practical Pharmacy Ed.),* v. 20, July 1959, p. 399-401.

**12352* On Variances of Ratios and Their Differences in Multi-Stage Samples.** Computation of the variances for ratio estimators which occur frequently in the analysis and presentation of results of sample surveys. Large-scale surveys, especially in the social sciences, are usually complex, multi-stage samples. The estimator used most frequently for presenting means, proportions and many aggregates is a ratio estimator of the kind described here. ***Leslie Kish and Irene Hess.*** *American Statistical Association, Journal,* v. 54, no. 286, June 1959, p. 416-446.

**12353* Accuracy Requirements for Acceptance Testing of Complex Systems.** A model has been constructed, in which the individual components of a complex system are tested in a go-no-go device containing errors in the test limits, and in which the measure of outgoing quality is the sum of the individual component errors. ***C. R. Gates and J. P. Fearey.*** *American Statistical Association, Journal,* v. 54, no. 286, June 1959, p. 447-464.

**12354* Optimum Designs in Regression Problems.** Although regression problems have been considered by workers in all sciences for many years, until recently relatively little attention has been paid to the optimum design of experiments in such problems. At what values of the independent variable should one take observations, and in what proportions? Purpose of this paper is to develop useful computational procedures for finding optimum designs in regression problems of estimation, testing hypotheses, etc. ***J. Kiefer and J. Wolfowitz.*** *Annals of Mathematical Statistics,* v. 30, no. 2, June 1959, p. 271-294.

**12355* Some Optimum Weighing Designs.** ***Damaraju Raghavarao.*** *Annals of Mathematical Statistics,* v. 30, no. 2, June 1959, p. 295-303.

**12356* Some Contributions to ANOVA in One or More Dimensions. I-II.** Two models are considered in detail, which are the Models I and II of ANOVA in the terminology of Eisenhart. The present paper, which deals with the one-dimensional or univariate case, and its sequel, which will deal with the multidimensional or multivariate case, seeks to give a unified general treatment, using matrix methods, of certain problems under the two models of ANOVA. The second paper presents certain natural extensions, to the multi-dimensional or multivariate situation, of the results contained in the first paper by the authors. ***S. N. Roy and R. Gnanadesikan.*** *Annals of Mathematical Statistics,* v. 30, no. 2, June 1959, p. 304-340.

**12357* Unbiased Estimation: Functions of Location and Scale Parameters.** Unbiased estimators for functions of a location parameter $\theta$, and a scale parameter $\rho$, are expressed as unknown functions in integral equations of convolution type, and are then obtained by integral transform methods. The main results consist in the application of various derived expressions to the exponential distribution with parameters $\theta$ and $\rho$, the gamma and Weibull distributions with parameter $\rho$, and to general distributions with truncation parameter $\theta$. ***R. F. Tate.*** *Annals of Mathematical Statistics,* v. 30, no. 2, June 1959, p. 341-366.

**12358* An Extension of the Cramér-Rao Inequality.** ***John J. Gart.*** *Annals of Mathematical Statistics,* v. 30, no. 2, June 1959, p. 367-380.

**12359* On the Attainment of Cramér-Rao and Bhattacharyya Bounds for the Variance of an Estimate.** If a variable $X$ has density function $f(x,\theta)$, then in many cases the Cramér-Rao bound or the Bhattacharyya bounds may be used to show that a function $d(x)$ is a uniformly minimum variance unbiased estimate of the real parameter $\theta$. ***A. V. Fend.*** *Annals of Mathematical Statistics,* v. 30, no. 2, June 1959, p. 381-388.

**12360* The Lagrangian Multiplier Test.** One of the problems which occurs most frequently in practical statistics is that of deciding, on the basis of a number of independent observations on a random variable, whether a finite dimensional parameter involved in the distribution function of the random variable belongs to a proper sub-set $\omega$ of the set $\Omega$ of possible parameters. In a recent paper by Aitchison and Silvey, the authors introduced, on an intuitive basis, a method of testing whether the true parameter does belong to $\omega$, this method being based on the distribution of a random Lagrangian multiplier appearing in the restricted likelihood equations. It is the object of this present paper to discuss this Lagrangian multiplier test. ***S. D. Silvey.*** *Annals of Mathematical Statistics,* v. 30, no. 2, June 1959, p. 389-407.

**12361* Intuitive Probability on Finite Sets.** ***Charles H. Kraft, John W. Pratt, and A. Seidenberg.*** *Annals of Mathematical Statistics,* v. 30, no. 2, June 1959, p. 408-419.

**12362* Asymptotic Expansions for the Smirnov Test and for the Range of Cumulative Sums.** ***J. H. B. Kemperman.*** *Annals of Mathematical Statistics,* v. 30, no. 2, June 1959, p. 448-462.

**12363* Asymptotic Minamax Character of the Sample Distribution Function for Vector Chance Variables.** ***J. Kiefer and J. Wolfowitz.*** *Annals of Mathematical Statistics,* v. 30, no. 2, June 1959, p. 463-489.

**12364* Bayes Solutions of the Statistical Inventory Problem.** From the point of view of statistical decision theory, a situation is examined in which the demand distribution is not known precisely. ***Herbert Scarf.*** *Annals of Mathematical Statistics,* v. 30, no. 2, June 1959, p. 490-508.

**12365* A Generalization of the Beta-Distribution.** A class of distributions is defined and studied, which includes as particular cases the ordinary $\beta$-distribution, the (univariate) triangular distribution, the uniform distribution over any non-degenerate simplex, and a continuous range of other distributions over such a simplex, called basic $\beta$-distributions and immediately analogous to the ordinary $\beta$-distribution. ***J. G. Mauldon.*** *Annals of Mathematical Statistics,* v. 30, no. 2, June 1959, p. 509-520.

**12366* Determining Bounds on Integrals With Applications to Cataloging Problems.** ***Bernard Harris.*** *Annals of Mathematical Statistics,* v. 30, no. 2, June 1959, p. 521-548.

**12367* On a General Concept of "In Probability".** Chernoff has called attention to a paper of Mann and Wald which provides a general theory and a convenient notation for the derivation of theorems concerning stochastic limits and limit distributions. The present paper attempts to clarify the first of these topics, stochastic limits, by applying one form of the definition of convergence in probability to any event rather than

just to convergence. ***John W. Pratt.*** *Annals of Mathematical Statistics*, v. 30, no. 2, June 1959, p. 549-558.

**12368*** **Densities for Stochastic Processes.** ***Charlotte T. Striebel.*** *Annals of Mathematical Statistics*, v. 30, no. 2, June 1959, p. 559-567.

**12369 Approximate Methods of Higher Analysis.** A systematic development of highly effective methods for approximate solution of the boundary value problems of classical mathematical physics. Presentation of the material and point of view are quite unique. ***L. V. Kantorovich and V. I. Krylov.*** 681 pp. 1958. Interscience Publishers, Inc., New York. (QA203 K13p4tr)

**12370*** **A Stability Criterion for Numerical Integration.** A necessary and sufficient condition is given for the absolute stability of multipoint numerical integration formulas for differential equations. The condition is that a certain matrix of low order, whose elements are computable from the coefficients of the integration formula, be positively definite. Two simple examples are given. ***Herbert S. Wilf.*** *Association for Computing Machinery, Journal*, v. 6, no. 3, July 1959, p. 363-365.

**12371*** **Safety Around the Clock—A Bell System Objective.** Nearly 600,000 employees of Bell System Telephone Companies are concerned with preventing off-the-job accidents as well as injuries while they are at work. ***Marguerite E. McCabe and Dorris W. Fauber.*** *Bell Telephone Magazine*, v. 38, no. 2, Summer 1959, p. 49-57.

**12372 Charles Darwin. Evolution and Natural Selection.** ***Bert James Loewenberg, editor.*** 438 pp. 1959. Beacon Press, Boston. (QH365 L82e)

**12373*** **Five-Percent Engineering?** ASCE needs to disabuse the minds of many laymen and some engineers of the persistent notion that engineering costs five percent—period. Think what it would mean to the profession if people could be made to understand that a thoroughgoing job of original engineering—whatever it costs—is in the interest of economy for nearly all important projects. ***Mason G. Lockwood.*** *Civil Engineering*, v. 29, July 1959, p. 33-34.

**12374*** **The Nature of Creativity.** After a brief historical outline of various theories of creativity, the author attempts to define and describe the creative process. ***Rollo May.*** *ETC. A Review of General Semantics*, v. 16, no. 3, July 1959, p. 261-276.

**12375*** **Creativity as Personality Development.** This article concerns creativity in human relations. Historical examples are found in social and political attempts to deal with differences. This type of creativity admits of one's own uniqueness and dignity and at the same time respects a uniqueness and dignity in others. ***Harold H. Anderson.*** *ETC. A Review of General Semantics*, v. 16, no. 3, July 1959, p. 277-302.

**12376*** **Creative Resources: Their Care and Nurture.** The point of view chosen for upheaval is that conflict is a burden to be endured. The substitute proposed is that creative resources find expression through the resolution of conflict or the reconciliation of contradictions. ***Franklin J. Shaw.*** *ETC. A Review of General Semantics*, v. 16, no. 3, July 1959, p. 303-311.

**12377 The Road to Scientific Supremacy.** The chief of Naval Research discusses the ingredients of a basic research program that can assure our scientific supremacy. ***Rawson Bennett.*** *Electrical Engineering*, v. 78, Aug. 1959, p. 794-798.

**12378 Estimation From Incomplete Data in Industrial Research. *H. O. Hartley.*** Paper from "Proceedings of the Statistical Techniques in Missile Evaluation Symposium", p. 179-198, Dec. 1958. Office of the Secretary of Defense and Office of Ordnance Research, Washington, D. C. (UG630 St29p)

**12379 Factorial Analysis for Non-Mathematicians.** Covers the essential processes of factor analysis in such a way as to make clear the underlying logic in simple language. The basic principles are sufficiently simple for the student to make some use of them in research and to be critically appreciative of research done by others. ***C. J. Adcock.*** 88 pp. 1954. Melbourne University Press, Carlton, N.s, Victoria, Australia. (QA242 Ad19f)

**12380 Application of Matrix Methods to the Linear Least Squares Synthesis of Multivariable Systems.** Class of systems treated in this paper is that characterized by a multiplicity of inputs and outputs. For such linear multivariable systems subject to continuous stochastic inputs with arbitrary self- and cross-correlations, a derivation is made of equations to be satisfied by the optimum transfer-function matrix. Criterion of performance which is used is minimization of the sum of the mean-square errors between the set of actual outputs and a set of desired outputs. ***R. C. Amara.*** *Franklin Institute, Journal*, v. 268, no. 1, July 1959, p. 1-16.

**12381 The Greatest Invention of Them All.** When the history of our era is written, the birth and development of the modern corporation must be recorded as a vital factor in our technological progress. Indeed, the corporation may well prove to be the greatest invention of them all. ***Henry B. Du Pont.*** *Franklin Institute, Journal*, v. 268, no. 1, July 1959, p. 17-23.

**12382 Note on Difference Equation Approximations of Laplace's Equation.** In the numerical solution of Dirichlet problems, one popular technique involves replacement of Laplace's equation by a difference equation approximation. This note completes a short series of papers on best difference equation approximations. ***Donald Greenspan.*** *Franklin Institute, Journal*, v. 268, no. 1, July 1959, p. 46-52.

**12383 Targets for Chemical Safety.** In spite of an outstanding safety record, work in a chemical plant is regarded by the general public as one of the most hazardous occupations. ***Robert H. Albisser.*** *Industrial and Engineering Chemistry*, v. 51, Aug. 1959, p. 61A-63A.

**12384 Experiments in Experimentation.** Vigorous interest is shown in the devising of new techniques in statistical design. ***W. J. Youden.*** *Industrial and Engineering Chemistry*, v. 51, Aug. 1959, p. 65A-66A.

**12385*** **Some Inequalities Satisfied by the Quantities of Information of Fisher and Shannon. *A. J. Stam.*** *Information and Control*, v. 2, no. 2, June 1959, p. 101-112.

**12386*** **Circle Networks of Probabilistic Transducers.** Consider a circle of devices, each characterized by a one-bit output which is statistically correlated with the outputs of its right and/or left neighbor at the preceding time period. It is shown that, provided no input-output relation is deterministic, this system will eventually become completely disorganized in the sense that it will behave like a collection of independent parts with completely unpredictable behavior. ***Manfred Kochen.*** *Information and Control*, v. 2, no. 2, June 1959, p. 168-182.

**12387*** **On the Singular Integrals. V.** Discusses integrability of the generalized Hilbert transform and reciprocal formula and analytic functions in an upper half-plane. ***Sumiyuki Koizumi.*** *Japan Academy, Proceedings*, v. 35, no. 1, Jan. 1959, p. 1-6.

**12388*** **Notes on Tauberian Theorems for Riemann Summability. II.** ***Kenji Yano.*** *Japan Academy, Proceedings*, v. 35, no. 1, Jan. 1959, p. 7-12.

**12389*** **Note on Finite Simple c-Indecomposable Semigroups.** Result of study of finite simple $c$-indecomposable semigroups except groups without proof, which shall be discussed precisely in another paper. ***Takayuki Tamura.*** *Japan Academy, Proceedings*, v. 35, no. 1, Jan. 1959, p. 13-15.

**12390*** **On a Theorem on Modular Lattices. *Yuzo Utumi.*** *Japan Academy, Proceedings*, v. 35, no. 1, Jan. 1959, p. 16-21.

**12391*** **Convergence Concepts in Semi-Ordered Linear Spaces. I.** Concerning semi-ordered linear spaces, L. Kantorovitch gave originally two different concepts of convergence, that is, order convergence and star convergence. One of the authors introduced two other concepts, that is, dilatator convergence and individual convergence, which are essentially equivalent to each other. Combining these concepts, star-individual convergence is obtained. These concepts of convergence and their combinations are discussed more systematically. ***Hidegorô Nakano and Masahumi Sasaki.*** *Japan Academy, Proceedings*, v. 35, no. 1, Jan. 1959, p. 25-30.

**12392* Reaction Time and EEG Activation Under Alerted and Nonalerted Conditions.** Behavioral alterting or attentiveness is associated with a blockade in the electro-encephalogram (EEG). Psychologically, set or attentiveness is reflected in reduced reaction time. ***Robert W. Lansing, Edward Schwartz, and Donald B. Lindsley.*** *Journal of Experimental Psychology*, v. 58, no. 1, July 1959, p. 1-7.

**12393* Motion Parallax as a Determinant of Perceived Depth.** The common assertion that motion parallax is a cue for depth perception is vague. The optics of differential velocities of the elements in a field of view were examined, and two cases were distinguished: that of two velocities in the field, and that of a gradient of velocities in the field. ***Eleanor J. Gibson, James J. Gibson, Olin W. Smith, and Howard Flock.*** *Journal of Experimental Psychology*, v. 58, no. 1, July 1959, p. 40-51.

**12394* A Comparison of Three Varieties of Training in Human Problem Solving.** Sixty-three Ss, divided into three groups, were given different distributions of 192 discrimination problem training trials, and then tested on the same transfer problem. The test results are cited. ***Lloyd Morrisett, Jr. and Carl I. Hovland.*** *Journal of Experimental Psychology*, v. 58, no. 1, July 1959, p. 52-55.

**12395* The Effect of Precision, Delay, and Schedule of Knowledge of Results on Performance.** Purposes of this investigation were to determine effect of variation of three variables, precision, delay, and schedule of KR on performance during 70 learning and 70 "extinction" trials. ***F. J. McGuigan.*** *Journal of Experimental Psychology*, v. 58, no. 1, July 1959, p. 79-84.

**12396* The Joint Influence of Practice and Instructions on Discrimination Reaction Time.** An experiment was performed on a visual discrimination reaction apparatus to test the hypothesis that specificity of instructions is a relevant variable in the acquistion of perceptual-motor skill. ***Clyde E. Noble, Wayne T. Alcock, and Roland L. Frye, Jr.*** *Journal of Psychology*, v. 48, July 1959, p. 125-130.

**12397 The Logic of Scientific Discovery.** Compares the roles of the scientist and the philosopher in the problem of understanding the world—including ourselves, and our knowledge, as part of the world. ***Karl R. Popper.*** 480 pp. 1959. Basic Books, Inc., New York. (Q175 P81Ltr)

**12398 Choosing the Right Color.** Ten basic steps for improving product appearance and appeal. ***Faber Birren.*** *Machine Design*, v. 31, Aug. 6, 1959, p. 100-106.

**12399 Alignment Nomograms.** Quick and easy ways to make alignment nomograms. ***Dimitri Kececioglu and Harold M. Weissman.*** *Machine Design*, v. 31, Aug. 6, 1959, p. 111-115.

**12400 Boston-'Hub' of Space Research.** Tracing development of a proud city's leadership in many fields of the space race; a look at the famous 'Golden Semicircle'—second in a series of regional surveys. ***William E. Howard.*** *Missiles and Rockets*, v. 5, no. 29, July 13, 1959, p. 12-13.

**12401 New Way to Packaging Control.** Dow Chemical's set-up illustrates today's corporate thinking: tight, professional control at the staff level, with committee participation down the line on specific problems. *Modern Packaging*, v. 32, no. 12, Aug. 1959, p. 81 + 6 pages.

**12402 New Work for Non-Skids.** Invisible coatings on cartons and cases put friction back to work for safe, economical stacking and shipping without impairing the looks of today's sleek, printed surfaces. *Modern Packaging*, v. 32, no. 12, Aug. 1959, p. 102 + 4 pages.

**12403* Functional Equations and Theta-Functions. I.** ***Richard Bellman.*** *National Academy of Sciences, Proceedings*, v. 45, June 1959, p. 853-854.

**12404* Generalized Conjugate and Analytic Functions Without Expansions.** ***S. Bochner.*** *National Academy of Sciences, Proceedings*, v. 45, June 1959, p. 855-857.

**12405* A Covering Homotopy Theorem and the Classification of G-Spaces.** Describes a classification theory for compact Lie transformation groups with a finite number of orbit types. ***Richard S. Palais.*** *National Academy of Sciences, Proceedings*, v. 45, June 1959, p. 857-859.

**12406* Orthogonal Latin Squares.** The principal purpose of this note is to display the first pair of orthogonal latin squares of order 10. ***E. T. Parker.*** *National Academy of Sciences, Proceedings*, v. 45, June 1959, p. 859-862.

**12407* The Brain and Cybernetics.** Discussed are responses of the brain to impulses. (*In Russian.*) Mozg i kibernetika. ***S. N. Braines and A. V. Napalkov.*** *Nauka i Zhizn'*, v. 26, no. 6, June 1959, p. 17-21.

**12408 The New Science.** Three essays: Where is science going? The universe in the light of modern physics. The philosophy of physics. ***Max Planck.*** 328 pp. 1959. Meridian Books, Inc. (QC3 P69n)

**12409* The Impact of Science on Our Future.** Describes effective developments in physics research. ***Donald W. Kerst.*** *Nondestructive Testing*, v. 17, no. 4, July-Aug. 1959, p. 217-219.

**12410* Coefficient Perturbation of a Constrained Extremum.** A schedule of allocating labor (in a shipping operation) whose available amount is a function of time, to different tasks, in order to minimize the total cost, is given. The problem is cast in linear-programming form in which all the coefficients are parameterized. ***Thomas L. Saaty.*** *Operations Research*, v. 7, no. 3, May-June 1959, p. 294-302.

**12411* Inference From Tests With Continuously Increasing Stress.** This paper contains a brief résumé of a mathematical foundation for construction and analysis of accelerated life tests. A special type of accelerated life test for capacitors is examined in detail. ***William R. Allen.*** *Operations Research*, v. 7, no. 3, May-June 1959, p. 303-312.

**12412* Traffic Analysis of Small Telephone Switchboards.** The emphasis in this work has been on maximal utilization under critical conditions, of the operator, lines, and subscribers, in the belief that in combat communications they are extremely important, and limiting factors should be known and understood so that corrective measures can be taken. ***James C. Coe.*** *Operations Research*, v. 7, no. 3, May-June 1959, p. 347-361.

**12413 History's Warning to Africa.** Discusses dilemma of the ruling minorities in Africa today in the light of history. ***Arnold Toynbee.*** *Optima*, v. 9, no. 2, June 1959, p. 55-59.

**12414 Flow of Native Labour to South African Mines.** An unprecedented number of natives is seeking mining employment in South Africa. Author examines situation. ***F. Rodseth.*** *Optima*, v. 9, no. 2, June 1959, p. 102-104.

**12415 Capital for Developing East and Central Africa.** Although foreseeing no shortage of equity capital for Central Africa, author expects that an increasing part will be played by intergovernmental lending and by institutions such as the World Bank in providing loan funds for East and Central Africa. ***J. P. McDonagh.*** *Optima*, v. 9, no. 2, June 1959, p. 106-112.

**12416* Are You Doing a Patchwork Quilt Material Handling Job?** Too many paper companies still leave the solution of handling problems to either an operating supervisor or to an industrial engineer on an assignment basis. This type of program will never realize the potential savings possible under an organized handling department. ***Donald S. Adams.*** *Paper Trade Journal*, v. 143, July 20, 1959, p. 40-45.

**12417* Automated Processing, USSR Style.** Describes visit to Tiflis tea plant which is "90% automated". ***Richard E. Stockwell.*** *Plant*, v. 20, July 1959, p. 27-30.

**12418 Symposium on Materials Research Frontiers.** Five papers on tailoring the properties of materials, nuclear materials, liquid fuels, and advances in physical metallurgy and glass research. 48 pp. 1959. American Society for Testing Materials, Philadelphia. (TA401 Am35s)